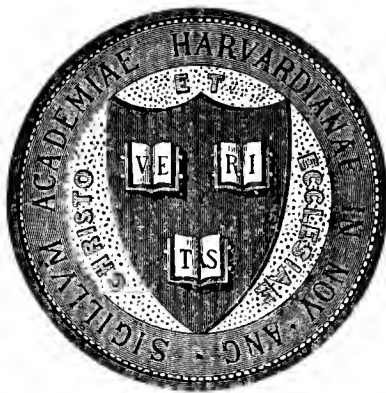


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ARBORETUM BULLETIN
OF THE
ASSOCIATES

OCTOBER, 1935

THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

VOL. I. No. 1

Set
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MORRIS ARBORETUM
CHESTNUT HILL
PHILADELPHIA, PA., U.S.A.

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25th July 1960

THE MORRIS FOUNDATION
Maintaining THE MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

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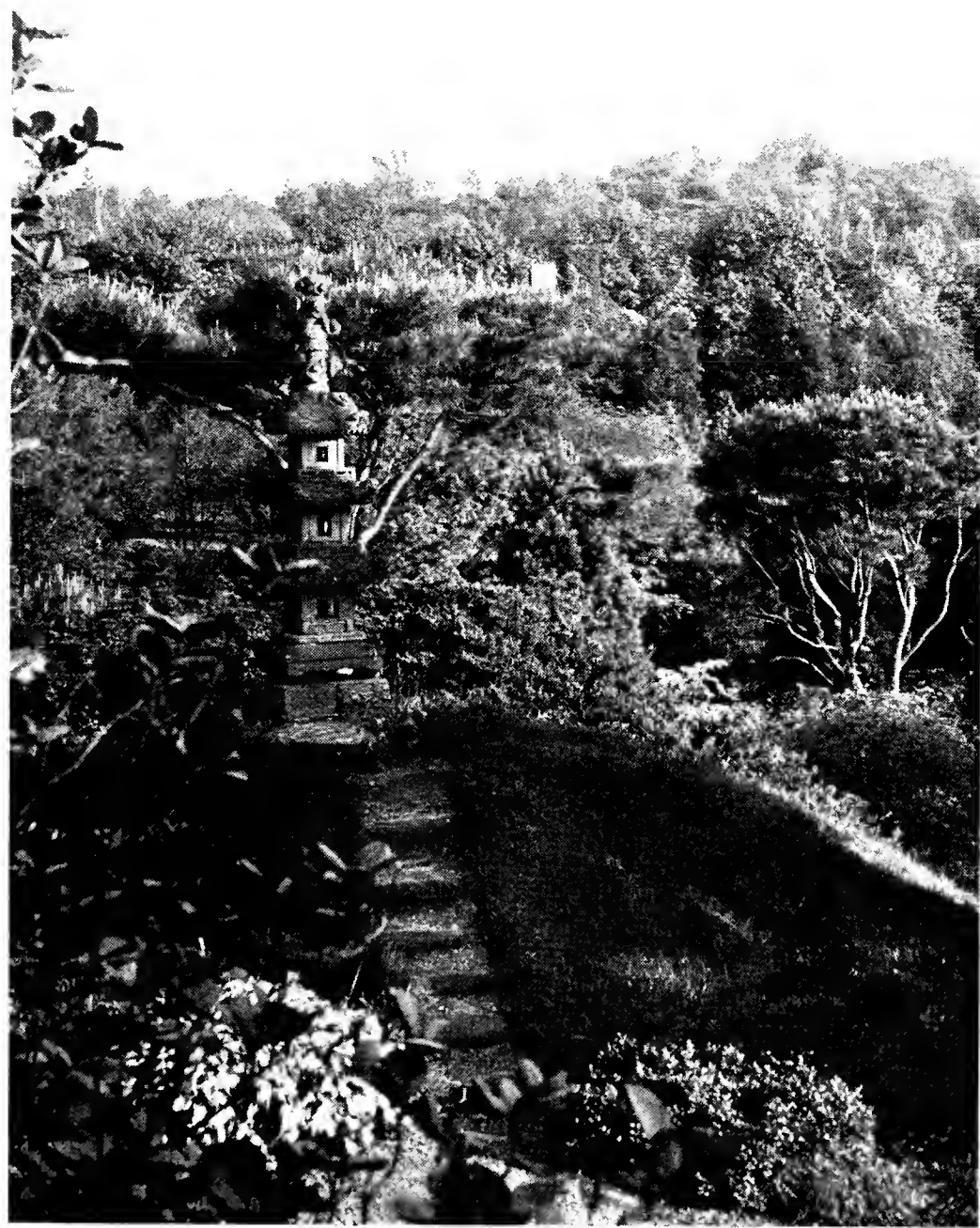
DR. RODNEY H. TRUE

DR. CLARENCE E. McCLUNG

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THE
MORRIS ARBORETUM
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View in Japanese Garden

FOREWORD

In an institution like the Morris Arboretum several types of interest meet, and there is likely to be a variety of happenings and experiences that are worth recording for the notice of those who may find an interest in such things.

Since the major scientific work of the Arboretum finds its outlet at present in other places, there remain a number of items, frequently of a non-technical character, that are worthy of attention.

Accurate information about rare species, interesting groups of trees and shrubs, resistance or susceptibility to climatic conditions, discussions of plant diseases, their causes and possible remedies, may appeal to some plant lovers.

Different ways in which the Arboretum is serving educational purposes in connection with the University and in other less formal ways, will interest others.

Announcements of the blooming times of special trees or shrubs, something concerning persons and organizations visiting the place, and other Arboretum news, may interest some who are more intimately acquainted with the place.

The progress of various scientific projects being carried on in the grounds or in the laboratories will be more significant to some readers.

It is hoped that a periodical, of which this is the first slender number, may be welcomed by the Associates of the Arboretum and by others who may be interested in its welfare and in its doings.

RODNEY H. TRUE, *Director.*

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BEGINNINGS AT THE MORRIS ARBORETUM

THE MORRIS ARBORETUM came under the control of the University of Pennsylvania on October 18, 1932, when fall foliage effects were waning and the trees and shrubs were preparing for winter.

Since the plantings had all been made to fit the pleasure taken by tree lovers in their home grounds, the material and arrangement naturally reflected these circumstances. The gradually developing history of the place, with older plants on ground first acquired and younger plantings made as plans were extended or changed, here finds expression.

The buildings on the place reflected the same history of old and new houses, acquired as new pieces of land were added. On October 18th, the total area consisted of about 160 acres of land, made up of about 90 acres in the "Compton" area and 70 acres in the more recently acquired farm—"Bloomfield." In addition to the Mansion that was the home of Mr. and Miss Morris in the later years, were three old stone houses and four newer ones serving as homes for the families of men employed on the place. In addition was the grist mill by the Wissahickon on the site of a Colonial predecessor with a small stone blacksmith shop nearby.

Use of Buildings

THESE STRUCTURES furnished the housing facilities available for the uses to which the Arboretum was to be devoted. In addition to the housing of persons attached to the Arboretum, the needs of other phases of the work of the institution had to be considered. The Mansion was temporarily adapted to the need for office and laboratory spaces and for rooms to house the herbarium of trees and shrubs collected on the place or acquired by purchase or exchange. Here the laboratory for forest pathology was also located and equipped with adequate facilities for research. The small beginning of a library was also planned in this building, and an equipment of steel shelving provided.

A small but useful auditorium was furnished with a seating capacity for about one hundred persons. Here lectures have been given to classes coming out from the University, also to others attending lectures on a variety of horticultural and botanical subjects during the winter months.

Use of the Land

THE SOIL of the Arboretum was found by Professor Edgar T. Wherry, Ecologist to the Arboretum, to consist of two types, according to the rock from which they were mainly derived. About half the total area, all on the home grounds, is made up of soil based on a mica schist or quartzite rock and has a mildly acidic reaction. The remaining area lying to the north and west overlies the limestone forming the floor of the Whitemarsh Valley, and has a reaction almost neutral. This fortunate diversity in acidity adds much to the opportunity for growing a variety of trees and shrubs. In general, the acid-loving conifers and relatives of the laurel, the Ericaceae, will be more at home on the slopes toward Chestnut Hill, while the roses and other lime-lovers will be best suited on the more level neutral soil on the other slope and on the Farm to the westward.

It became important to provide for the future of the Arboretum by developing replacement material and young plants for use in the group plantings to be made later, in which related groups should be brought together in some botanical relationship. Accordingly, a nursery was laid out at the Farm to receive young stock as it might be developed. Later, as more young material demanding acid conditions came forward, a nursery was prepared on the more acid land near the greenhouses.

Connections were made promptly with Botanical Gardens of Europe and Asia in the hope of securing seeds of plants not to be found at the Arboretum. Since the American trees and shrubs were but sparingly represented in the plantings of the Arboretum, plans were also made for bringing in the native species as time and opportunity might permit.

Public and Educational Uses

SINCE THE LARGE collection of rare and often beautiful trees and shrubs that make up the main feature of the planting at the Arboretum offers a genuine pleasure to many people and since the educational value of such a collection is a very real part of its use, the grounds were thrown open to visitors on several afternoons each week. The value and rarity of the collection has made it an important trust committed to the Arboretum management, to be properly safeguarded through the operation of a minimum number of common-sense rules.

On two occasions each year the Arboretum has been opened all day for a Spring Saturday and successive Sunday, at such a time as seems likely to show the best floral effects, and again in the Fall for a similar period, chosen with reference to foliage effect.

In May, the women of the University have their May Day Frolic, with the crowning of the Queen and the giving of a play at the Arboretum, with several thousand visitors on the grounds.

The usual number of visitors during the Spring and Summer months has been about 300 a month.

Lecture Course

A LECTURE COURSE of five lectures dealing with a group of related subjects of interest to plant growers has been given in the auditorium on the second Saturday of December, January, February, March and April. Speakers well known for their knowledge and experience in the subjects dealt with have been obtained and they have spoken to appreciative audiences.

Labeling of Collection

SINCE MANY VISITORS who come to the Arboretum give some careful attention to the plants and wish to know their names, durable lead labels similar to the type used in the Royal Botanical Gardens at Kew, England, have been made and are either attached to the trees or set in the ground near them. The label gives the botanical name, the common name in case such is known in the English language, and the geographical source of the plant. Since the botanical identity of all plants has not yet been clearly established, and since common names in English have not yet come into use for all of these foreign plants, some of these features may not appear on the label. A further study of the flora of China and Japan may in time remedy the first deficiency.

Distribution of Seeds and Plants

IT NOT infrequently happens that a high percentage of germination of seeds, or good fortune with cuttings, yields a larger number of plants of given species than the Arboretum needs demand. Accordingly, these have been offered to the Associates in limited quantities for the purpose of securing wider distribution and broader information regarding their behavior in this region. These are regarded essentially as experimental plantings, oftentimes involving plants of which little is known. Some of the Rhododendrons grown from seeds collected by Dr. Joseph F.

Rock in Tibet and China illustrate this class. Sometimes less known plants found to be of interest in the Arboretum are propagated by seed or cuttings from plants growing there. The Chinese tree, *Evodia*, illustrates this type of plant.

The list of seeds offered to Associates last Spring, and still in part available, includes 82 species and varieties, many of them being Asian in origin, some European, and a few native. Some of them are well-known deciduous ornamental types like *Clematis viticella* L., *Kolkwitzia amabilis*, L., the well-known beauty bush, *Sambucus* of several types, and the sorrel tree, *Oxydendron arboreum* D.C. Several types of evergreens are also listed—*Chamaecyparis nootkatensis*, the nootka cypress, *Kalmia latifolia*, the mountain laurel, *Thuja occidentalis*, the white cedar, and *Tsuga canadensis*, the common hemlock, being among the number. By far the greater part of the list consists of less well-known plants, some of which are in an experimental stage here. Most of the seeds were collected at the Arboretum.

The list of plants in pots or in the nurseries offered to the Associates includes 95 species and varieties. Here, again, the material is largely of foreign origin, and familiar sorts are included. Among these are three types of Boxwood, four of Asian *Cornus* species, four *Deutzias*, four *Hypericums*, six *Ligustrums*, privets, sixteen *Loniceras*, honeysuckles, interesting not only for their flowers, but also for their fruits that are very much appreciated by the birds that haunt the Arboretum, eight *Philadelphus* types from a very large collection growing at the Arboretum, nine *Poplars* of a rapidly growing type developed for commercial purposes, three *Symphoricarpus* sorts, coral berries or snow berries, and many other species and varieties. Among these some deserve special mention. The Asiatic tree, *Evodia Daniellii*, from Northern China and Korea, may be noted. It is a small tree bearing compound leaves and corymbs, five to eight inches across, of small whitish flowers. Thus far it has suffered but minor injury by the frost of the past severe winters at the Arboretum and seems likely to be worth a trial.

The Rock Rhododendrons, now available in pots, are in the early experimental stage. Some are likely to be hardy here, and others are quite likely to be plants for greenhouse culture. The great variety of characters seen in this group seems to suggest considerable possible value for hybridization purposes.

A number of seedlings of the Chinese small-leaved elm, *Ulmus parvifolia* Jacq., are likely to be interesting in time. At the Arboretum this tree has almost semi-evergreen characteristics and is thoroughly hardy. It is reported, however, to be susceptible to the so-called Dutch Elm Disease.

Many of the plants listed are in the nursery ready for transfer as soon as dormant.

ARBORETUM NEWS

Mr. Sinkler's Gift of Insectivorous and Tropical Plants

THE REMARKABLE COLLECTION of plants brought together by Mr. Louis Burk at his home in Latham Park has attracted the attention of plant lovers and plant students who have visited the annual Philadelphia Flower Shows of past years. One of the most striking novelties of Mr. Burk's more recent exhibits has been a very complete collection of our native insectivorous plants. The bizarre forms of these plants and their exceptional nutritional habits have singled them out as one of the most remarkable groups of specialized plants that we have.

With the regrettable passing of Mr. Burk, the collection of insectivorous plants was offered for sale. Fortunately for the Arboretum and for the University of Pennsylvania, an interested alumnus of the University, Mr. Wharton Sinkler (U.P. '06), purchased this entire collection and presented it to the Arboretum, where it can be seen by interested visitors. This collection consists of 159 plants, of which 127 are native American pitcher plants. The collection includes several hybrids, as well as native species.

Mr. Sinkler also purchased and presented to the Arboretum the Burk collection of 62 Bromeliaceae made up of 30 species and hybrids. These epiphytic plants grow on the branches of trees in the moist tropics, where they catch water in their pitcher-like leaf bases and develop many striking and beautiful types of vegetation far above the ground.

Mr. Burk also had made a rare collection of Anthuriums in which he developed a group of unique hybrids. Mr. Sinkler included this collection of 29 plants in his splendid gift.

A group of 69 tropical foliage and flowering plants from several natural groups, including many types rare now both in private and in commercial collections, including a specimen of the rarest of the stag horn ferns, the great *Platycerium grande*, and other notable species, were included in Mr. Sinkler's gift, now open for inspection in the greenhouses of the Arboretum.

Colonel Robert H. Montgomery's Gift of Evergreens

THROUGH THE GOOD offices of Mr. Maurice Bower Saul, one of the members of the Advisory Board of the Arboretum, Colonel Robert H. Montgomery, of New York City, recently presented to the Arboretum a splendid shipment of evergreens from his Cos Cob nurseries. In the carload sent are nearly 2000 trees of different sizes, representing over 215 species and varieties. Among the number are many rare and beautiful types. These trees have been planted in the new nursery below the greenhouses, where they add greatly to the interest of the place for tree lovers and tree experts. As the trees reach sufficient size, they will form parts of the several conifer groups to be planted in the sections of the Arboretum devoted to those trees. Some of doubtful hardiness will be given the treatment made necessary by this fact. Through the bounty of Colonel Montgomery, the Arboretum thus becomes the possessor of one of the most complete collections of varieties of conifers in this country.

WINTER LECTURE COURSE

DURING THE PAST two winters, a course of lectures on subjects of interest to plant growers has been given in the small auditorium at the Arboretum. The subjects dealt with have been important groups of ornamentals discussed by persons recognized as authorities in these groups.

During the coming winter the general line of subjects to be dealt with concern important pathological problems of woody plants. Lecturers have been secured who have themselves carried on important researches in the problems they discuss.

The winter's program is as follows:

December 14, 1935

DR. CURTIS MAY

The Dutch Elm Disease.

Dr. May is in charge of the laboratory investigations now being carried on by the United States Department of Agriculture at Morristown, N. J.

January 11, 1936

DR. L. W. R. JACKSON

The Diseases of Plane Trees.

Dr. Jackson is in charge of the pathological investigations in the Forest Experimental Station of the United States, co-operating with the University of Pennsylvania.

February 8, 1936

DR. HARLAN H. YORK

Diseases of the Himalayan Pine and Other Ornamental Conifers.

Professor York is the head of the laboratory of Forest Pathology, University of Pennsylvania, and Pathologist to the Arboretum.

March 14, 1936

MR. HENRY TEUSCHER

Winter Injury and Hardiness.

Mr. Teuscher is Dendrologist at the New York Botanical Garden.

April 11, 1936

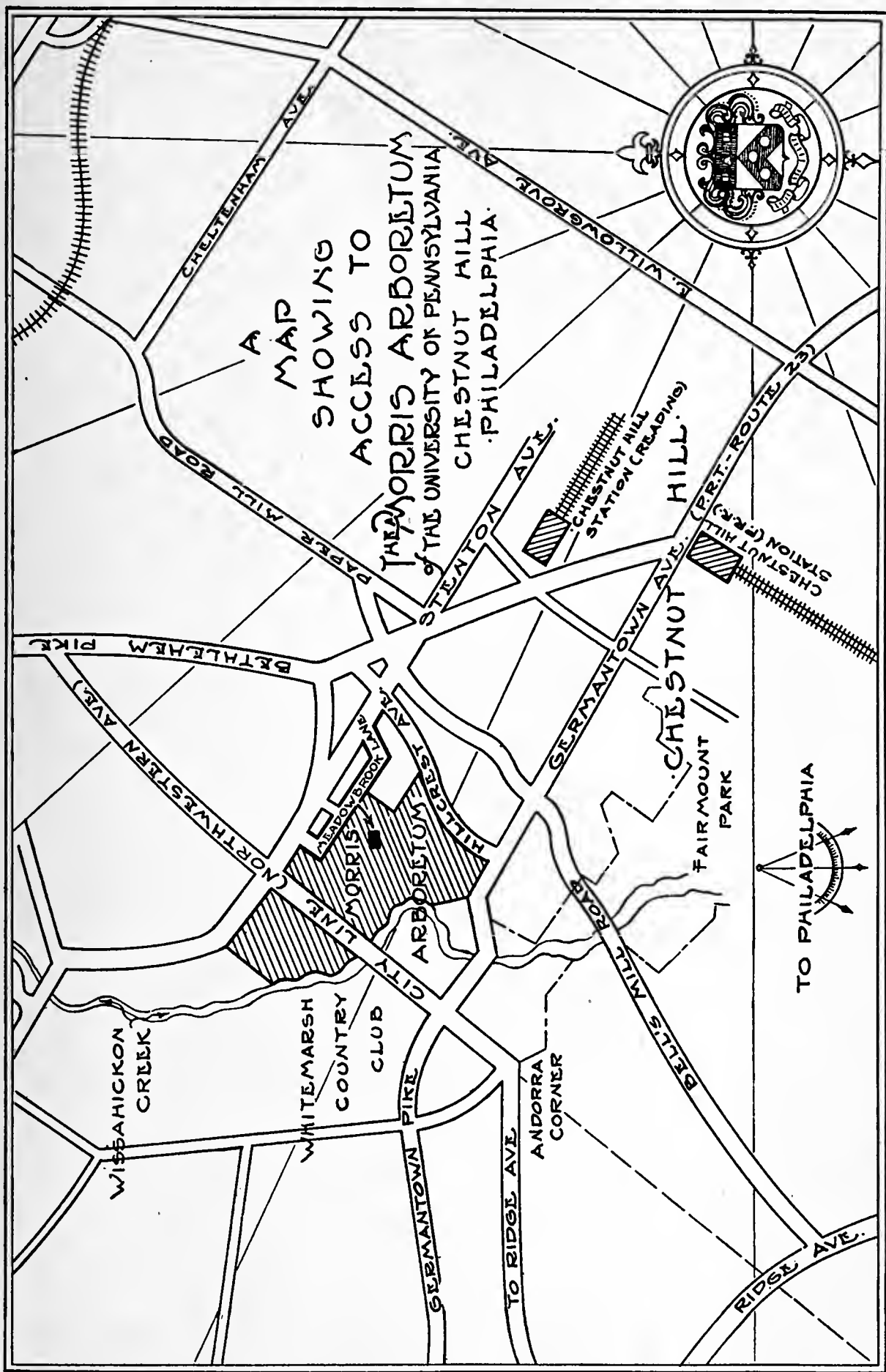
DR. WILLIAM CROCKER

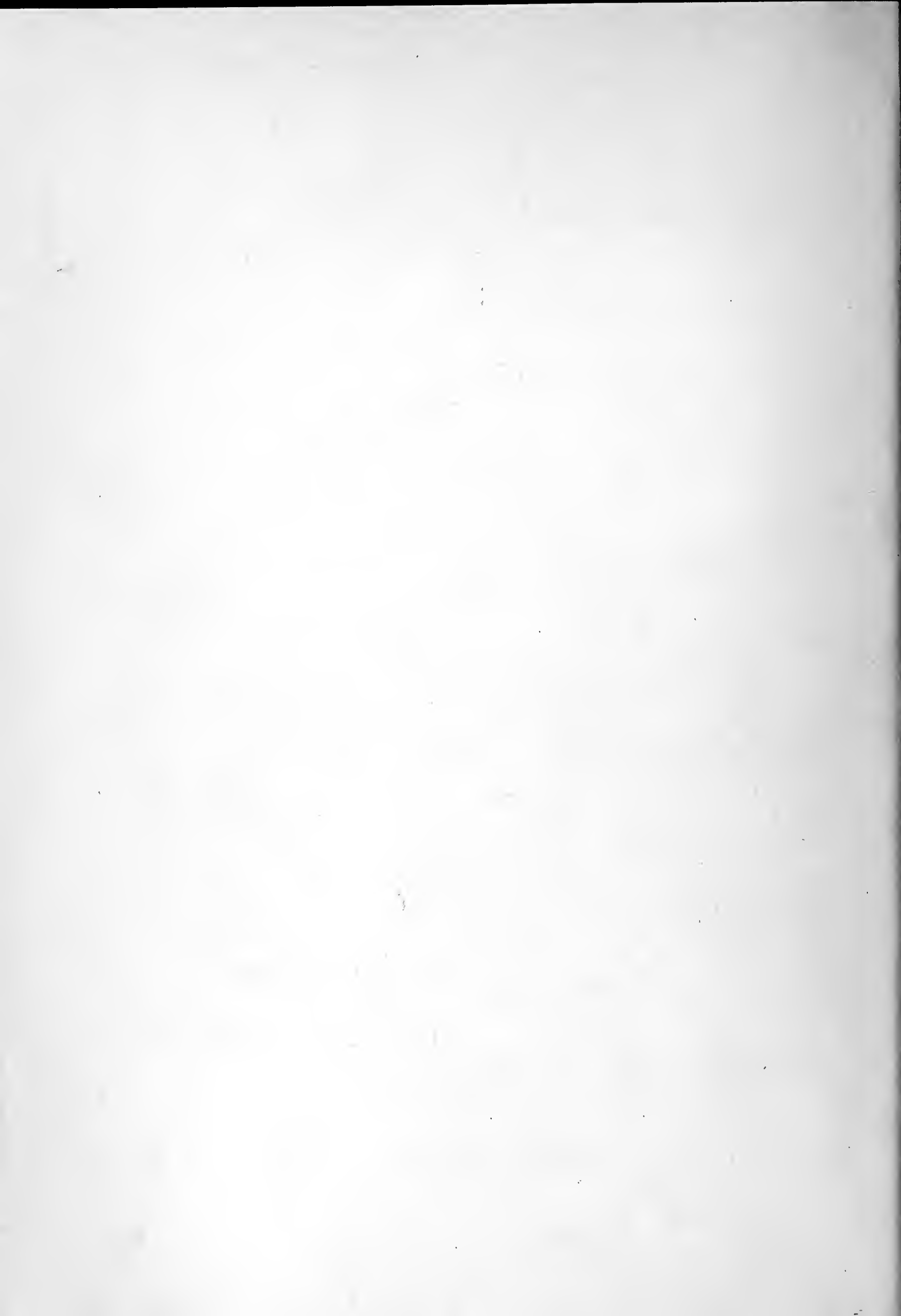
Injury Caused by Illuminating Gas.

Dr. Crocker is Director of the Boyce Thompson Institute for Plant Research at Yonkers, New York, and is an eminent investigator and authority on this subject.

These lectures will present the results of much specialized scientific research and will apply these results to practical problems.

Lectures come on the second Saturday of each month.







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JANUARY, 1936

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VOL. I. No. 2

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View in the Pinetum

The illustration on the title page of this number is a view showing a part of the road running through the Pinetum toward the Swan Pond. Coming into the left side of the picture are the pendant tassels of a large Himalayan Pine (*Pinus excelsa* Wall).

Among the smaller evergreens standing at the sides of the road are specimens of Cypress (*Chamaecyparis*) the Swiss stone pine (*Pinus Cembra* L.) spruces and hemlocks, mostly of Asiatic origin.

High over all in the background is seen the spreading top of a weeping willow (*Salix babylonica* L.) rooting in the bank of East Brook near the bridge.

RODNEY H. TRUE

WINTER INJURY TO BOXWOOD AT THE MORRIS ARBORETUM

IN RECORDING the injurious effects of sub-zero temperatures on Boxwood during the winter of 1933-34, the writer had listed the unusual injurious effects on a percentage basis, discarding entirely the average winter injury, according to the known hardiness of the species. While it is of importance to record the actual damage caused by intense cold during winter, which is intensified by the warm spring sunshine and rapid thaws, it is also of importance to record the percentage of recovery which, after all, is the ultimate result, whether it becomes partial or permanent recovery or death to the specimen.

In figuring on a percentage basis, no actual measurements were made, it being done by guesswork, so that the percentage of injury is approximate. Care has been taken also in determining the killing of the entire plant, including the root system. During the following spring pruning, species that were found to be killed to the ground were cut back to the root-stock and allowed to remain in the ground until late summer. Thus, adequate time for development of growth was assured. The percentage of injury may be represented by a thinning-out of individual growths and, in severe cases, the entire vegetative growth destroyed. In most cases the shedding of the old foliage was very pronounced, especially in unclipped (natural growth) specimens, but by this shedding of leaves approximately 80% of the boxwood leaf miners were destroyed. It was also observed that when boxwood foliage was deficient in chlorophyll during the preceding summer and fall, death of the entire growth invariably resulted the following spring. While we may regard cold spells and sudden thaws as the most destructive agencies during the average winters, causing surface injuries of a temporary rather than permanent nature, it has been observed that deeper-seated injuries to internal structure, resulting from severe sub-zero temperatures, were the contributing factors in the permanent injury from which the boxwood did not recover. It would be difficult to record the hardiest species of *Buxus* from the accompanying list, for although a few showed no injurious effects, the same specimens might have been badly damaged under different environment.

These records do show conclusively that the Korean Boxwood—"Buxus microphylla Koreana"—which has been thought to be one of the hardiest species, is the tenderest species of them all according to those grown in the Arboretum. Different environmental conditions, high and low ground, protection from other trees and shrubs, did not affect the results. In presenting the following list of species of Buxus, together with the Arboretum records of low-temperature injuries, the size, shape and exposure of the specimen, and other general information that may prove of value, has been included to make the records as complete as possible.

Except as otherwise indicated, the plants noted below grew on a hillside with southern or southeastern exposure.

Buxus sempervirens, L.—M360

Bushy specimen, 7 ft. to 8 ft. high—10% injury to young growths partially protected by tree. Recovery slow.

Buxus sempervirens angustifolia West—M634

Natural growth, 9 ft. to 10 ft. tall. Removal of old leaves only. Good foliage developed during the summer.

Buxus sempervirens arborescens L.—M363

Natural growth 6 ft. high—No injury.

Buxus sempervirens arborescens L.—M359

Larger natural specimen 15 ft. high—No injury.

Buxus sempervirens Handsworthii K, Koch—M357

Large spreading loose-branched specimen—Uninjured.

Buxus Harlandii, Hance—M351

Natural specimen 10 ft. high. Foliage badly stripped along branches—50% injury—recovery slow.

Buxus sempervirens myrtifolia, Sweet—M1634

Clipped specimen 6 ft. high—10% injury on northwest side only.

Buxus sempervirens rotundifolia, Baill.—M355

Formal specimen—40% injury. Recovery good, especially on old wood.

***Buxus sempervirens rotundifolia*, Baill.—M352**

Large specimen—no damage.

***Buxus sempervirens rotundifolia*, Baill.**

Nine healthy sheared specimens 6 ft. high x 6 ft. spread growing in windswept valley, north and northwestern exposure, slight hillside; Specimens 1 and 2 on low ground—60% of branches killed—did not recover. Specimens 3, 4, 5 and 6 growing on slightly higher ground—90% injury—no recovery. Specimens 7, 8 and 9, growing on higher ground, exposed to west winds and sunshine—no injury to growth and foliage.

***Buxus sempervirens suffruticosa*, L.—M376**

Sheared specimen 5 ft. high, 7 ft. spread, fully exposed to south and southwest—uninjured, not even leaf-burn.

***Buxus sempervirens suffruticosa*, L.—M377**

Same as above—uninjured.

***Buxus sempervirens suffruticosa*, L.—M1810**

Specimen 4 ft. high growing in low wet ground—95% killed—no recovery.

***Buxus sempervirens rotundifolia*, Baill.—M350**

Large spreading semi-natural growth—10% injury. Recovery good on old stems.

***Buxus sempervirens variegata*, West—M372**

Spreading specimen of natural growth—90% reverted to type (plain green)—no injuries.

***Buxus sempervirens variegata*, West**

Low spreading natural growth, 4 ft. high—no injuries.

***Buxus Balearica*—M374**

Specimen 9 ft. high, semi-natural growth. East and northeast exposed side unaffected. Southern exposed side 80% killed. Recovery very poor.

***Buxus microphylla Koreana*, Nakai—M362**

Large spreading specimen growing on hillside—south and southeast exposure. Entire plant killed. This species is the most tender of all the boxwoods.

***Buxus microphylla* Koreana, Nakai—M703**

In protected place in Japanese Garden—southeast exposure—80% killed. Growth protected by snow—uninjured.

Small plants 6 to 8 inches high of *Buxus sempervirens suffruticosa*, *Buxus sempervirens Handsworthii* and *Buxus microphylla* Koreana, planted on high ground with southwestern exposure, wintered perfectly due to a covering of snow during the extreme low-temperature period.

***Buxus sempervirens suffruticosa*, L.**

Bushy compact plants 2 ft. high used as an edging and growing on high, flat terrace fully exposed to south, southeast and southwest winds. Plants in four long rows for the purpose of dissecting a formal rose garden.

In the plants in rows running southwest to northeast, spring leaf-burn was decidedly above normal and recovery was good. Permanent injury to growths or branches was 10%. The major part of this injury represented entire plants killed to the ground or individual branches completely killed. Leaf-burn, as usual, was more pronounced on the south and southwestern side that is subject to intense sunshine. The plants were finally removed, pruned back and planted in nursery rows for growing on, but the development of vegetative growth from these plants has been very poor.

JAMES LAMBERT.



BIRDS AT THE ARBORETUM IN LATE FALL

THE AREA constituting the Morris Arboretum includes two portions, one about ninety acres in Philadelphia County enclosed by the iron fence. This area contains two small brooks, the shore line of the Wissahickon Creek, upland and lowland, many conifers, several thickets, and a large number of trees growing singly and in groups. The other area of farm land, Bloomfield, consists of seventy acres of open rolling land in Montgomery County on the opposite side of Northwestern Avenue, and offers a quite different set of surroundings.

The lowland will be greatly improved ornithologically when shrubs, willows and a few clumps of alder are planted on the banks of the brook which takes its course through the meadow, and also when sedges and cattails grow in and alongside of the small marshy backwater of the creek.

On the higher parts an excellent opportunity for observation of birds presents itself. It will be most interesting to see how the winter species react to the berries on the exotic trees and shrubs, especially the northern forms driven south by severe weather and lack of food.

The small number of English Sparrows is rather remarkable. There is a flock of five or six, which can be found around the garage, but even these are not always in evidence. During November of this year (1935) more Yellow-bellied Sapsuckers were recorded than have ever before been seen by the writer in any one Fall. This most likely was due to a migration "wave" and was an extraordinary sight. Twenty Cedar Waxwings have been feeding on the berries borne by several trees in the group on the high ground of Hillcrest Avenue, and it is assumed that they will remain as long as the supply lasts. The Arboretum apparently has its full quota of what might be called the winter insect destroyers, such as the Downy Woodpecker, Brown Creeper, Tufted Titmouse, Blackcapped Chickadee and White-Breasted Nuthatch.

It was a distinct pleasure to find three individuals of the Red-tailed Hawk resting in and flying over this location. The undeserved and unwarranted persecution of Hawks and Owls in general, instigated by "sportsmen's" organizations and ammunition manufacturers, has greatly diminished these birds, and the really bene-

ficial ones have suffered the most. Red-tailed Hawks are decided benefactors of the agriculturist and silviculturist, but being large and noticeable, are easily shot. Two Cooper's Hawks find happy hunting grounds here, as they live on small birds and poultry. This species and the Sharp-skinned Hawk are the two worst offenders in this part of the country. They are comparatively small and being swift, and as a rule staying close to cover, are seldom seen by the average person.

The following list shows the species found and their relative abundance during November and half of December of 1935:

Eastern Green Heron—*Butorides virescens virescens*

An individual of this species was to be found during November by the brook which runs through the meadow.

Common Mallard—*Anas platyrhynchos platyrhynchos*

Two were seen acting in such a wary manner that they must have been wild.

Cooper's Hawk—*Accipiter cooperi*

Two were observed, one staying close to the Avenue of Oaks and the other in the trees by the Pond.

Eastern Red-tailed Hawk—*Buteo borealis borealis*

Three appeared together; two were perched in the woods and the third soaring over the meadow.

Northern Red-shouldered Hawk—*Buteo lineatus lineatus*

One was discovered perched in the trees by the Pond.

Eastern Sparrow Hawk—*Falco sparverius sparverius*

Only one seen and that flying over.

Ring-necked Pheasant—*Phasianus colchicus torquatus*

Several can usually be flushed where upland brook joins the creek.

Eastern Mourning Dove—*Zenaidura macroura carolinensis*

One seen flying over.

Eastern Belted Kingfisher—*Megaceryle alcyon alcyon*

Can as a rule be seen or heard along the creek.

Yellow-bellied Sapsucker—*Sphyrapicus varius varius*

A great many passed through and were observed only in the fruit trees and by the Pond.

Eastern Hairy Woodpecker—*Dryobates villosus villosus*

Only one of this species seen.

Northern Downy Woodpecker—*Dryobates pubescens medianus*

May be seen wherever there are trees and shrubs.

Northern Blue Jay—*Cyanocitta cristata cristata*

Usually in evidence, but being a wanderer, is at times absent.

Eastern Crow—*Corvus brachyrhynchos brachyrhynchos*

Always to be found and several large flocks were seen passing over.

Black-capped Chickadee—*Penthestes atricapillus atricapillus*

Several are usually in the woods by the creek.

Tufted Titmouse—*Baeolophus bicolor*

Two or three can always be observed in the woods.

White-breasted Nuthatch—*Sitta carolinensis carolinensis*

Several are always in the trees along the creek.

Red-breasted Nuthatch—*Sitta canadensis*

Only one seen and that in the trees by the boathouse.

Brown Creeper—*Certhia familiaris americana*

One or two usually in evidence on any tree, whether standing alone or in a group.

Eastern Ruby-crowned Kinglet—*Corthylio calendula calendula*

Found several times singly in the evergreens by the house on Hillcrest Avenue, in the Japanese Garden, and in the thicket near the greenhouses.

Cedar Waxwing—*Bombycilla cedrorum*

A flock of twenty has been feeding on all the trees with berries, except the holly.

Starling—*Sturnus vulgaris vulgaris*

Not as many as expected. Several can always be found in the trees in the meadow and along the creek.

English Sparrow—*Passer domesticus domesticus*

Few in number and found only by the garage.

Eastern Cardinal—*Richmondia cardinalis cardinalis*

Two pairs appear to have divided that part of the Arboretum between the office and Hillcrest Avenue, one pair staying to the east of the Pond and the other to the west of it.

Eastern Goldfinch—*Spinus tristis tristis*

Several in their wanderings occasionally pass through.

Slate-colored Junco—*Junco hyemalis hyemalis*

Present in great numbers and can be seen anywhere except the meadow.

White-throated Sparrow—*Zonotrichia albicollis*

A flock can always be found in the low evergreens and bushes at the end of the Avenue of Oaks.

Eastern Fox Sparrow—*Passerella iliaca iliaca*

Several passed through on migration.

Eastern Song Sparrow—*Melospiza melodia melodia*

Occasionally seen along the creek.

LEWIS MACCUEN SMITH.



MORRIS ARBORETUM MONOGRAPHS

I.

THE FIRST Morris Arboretum Monograph was published in December, 1935. It is entitled *The Beginnings of Plant Hybridization* and is written by Conway Zirkle a member of the Arboretum Staff.

The opening chapter deals with the earliest descriptions of both plant and animal hybrids. Even in prehistoric times, cultivated varieties of plants were accidentally crossed and the valuable hybrids were unconsciously selected by the primitive agriculturists. Species crosses in animals were knowingly made and the common farm animal, the mule, existed as early as 800 B. C. Indeed the classical and medieval philosophers had a great deal to say concerning animal crosses and they described many fantastic and impossible hybrids. Eels and vipers supposedly interbred as did lions and panthers, horses and cows, camels and pigs, etc. During the sixteenth, seventeenth and even the eighteenth century it was believed that human beings often crossed with apes, bears, dogs and other animals.

During the greater part of this period grafting was a common practice and many attempts were made to cross plants in this manner. It was not until the end of the seventeenth century that the possibilities of cross pollination were recognized. The first authentic report of plant hybridization was in a letter written by Cotton Mather in 1716, but by 1761, when Koelreuter's famous work appeared, plant hybridization was well known. Surprisingly enough much of this work was done in the American Colonies, work which is described by the Monograph in detail. Twenty-nine accounts of plant hybridization before Koelreuter are reprinted in full, including several letters of John Bartram.

The Monograph sells for \$2.50 but a special price of \$1.88 is made to Associates of the Morris Arboretum who purchase through the Arboretum.

R. H. T.

THE DUTCH ELM DISEASE—SUMMARY OF LECTURE

BY

MR. CURTIS MAY

AT THE

MORRIS ARBORETUM—DECEMBER 14, 1935

THE SO-CALLED Dutch Elm Disease is due to a fungal parasite that lives on susceptible species of elms and in so doing causes the death of the trees. Like other

serious parasites that have wrought havoc with American plants, it is of foreign origin and came to the attention of scientists abroad only at a late date. It attracted attention in Holland in 1918, but was soon reported from Great Britain, France and other European lands, where it developed serious problems.

The Dutch pathologists of the University of Utrecht, led by Professor Johanna Westerdijk, made the first scientific study of the disease and determined its cause. When their results were made public, the disease came to be known as the Dutch Elm Disease, although not Dutch in origin.

It came to America rather promptly, probably about 1926, in elm logs having the fungus and the beetle through which it is mainly distributed. It escaped recognition for a short time, during which diseased logs were shipped to different manufacturing centers, mainly in the Middle West. When detected, the importation of the elm logs was stopped, but the disease and one of the beetles distributing it had already begun work at the ports of entry, along railroad lines leading from port to factory and in the neighborhood of cities in which the elm logs were turned into furniture.

In 1930 it was found in Cleveland and Cincinnati, and in 1933 and 1934 at Baltimore and New York and Norfolk, the points of entry.

In 1933 the disease was found in Northern New Jersey, and Federal and State agencies mobilized to study the situation in that place. In 1933 scouts were sent into the field, taking samples of the wood from suspicious trees, from which the laboratory technicians cultivated out the fungus and identified it.

The region included within a radius of fifty miles from New York proved to have the worst infection, with slight infections elsewhere. This area continued to be the main center of trouble.

Two arms of the Federal service, both in the Department of Agriculture, are working on this problem. The scouting work is done by men from the Bureau of Entomology and Quarantines. The technical laboratory studies are carried out by the Division of Forest Pathology of the Bureau of Plant Industry with headquarters at Morristown, N. J. The work thus far done indicates that the fungus lives in the sap wood of the trees, in which it does its damage and in which it fruits. It seems clear that it enters the tree through the borings of one or more bark beetles (*Scolytus*) that bear the spores of the fungus (*Ceratostomella*) either on their appendages and bodies or internally.

It seems that the disease is carried over in weak elm trees, from which healthy ones are attacked. Hence, the importance of cleaning out the weak trees as a sanitation measure. Fortunately, the disease seems not to spread as rapidly as the chestnut blight.

The present measures being taken against this menace are:

1. Scouting to determine the location of diseased trees.
2. The removal of these, with treatment of the stumps and wood to kill the organism.
3. The sanitation work, involving the removal of weak trees in swamps and similar places in which the disease might persist.

The scout watches all of our native elms for wilted leaves, that may be green if the branch is recently attacked, yellow in later stages. He looks for brown streaks in the outer sap wood when the bark is removed; in sections of infected branches a brown ring is seen in the outer sap wood. Since there are other elm diseases of a less serious character, with which the Dutch Elm Disease may be confused, the cultivation of the *Ceratostomella* on proper culture media in the laboratory with the appearance of its characteristic fruiting bodies is needed to give a certain identification.

Since the fungus lives saprophytically in dead elm wood, the problem of dead infected trees becomes important. Wood piles of elm wood, stumps and decaying trunks may prove to be important sources of trouble.

The disease is known in Virginia (Norfolk), Indiana and in New York, extending into New Jersey and Connecticut. It has not yet been found in Pennsylvania. The results from the work thus far done indicate that if complete eradication cannot be accomplished, control of the disease may be practicable.

Persons having elms that offer suspicious symptoms may have specimens examined at the Laboratories in Morristown, New Jersey. Several pieces of wood from smaller branches from $\frac{1}{2}$ " to 1" in diameter and 6 inches long, showing brown discolorations of the sap wood, offer favorable material for investigation. Since the disease is spread through the weak trees that act as host for the young beetles, tree owners should try to keep their elms in good condition, but should avoid over-fertilization. Infected trees should be removed as completely as possible, since the disease germ sometimes passes from tree to tree through root grafts made in the ground.

As to susceptibility, no species of American elms are believed to be immune or resistant. Some of the Asiatic kinds are more so.

Since no remedy for the disease is known, and since the danger of spread is very real, trees with this disease should be cut down and the wood burned to destroy the parasites.

Reported by RODNEY H. TRUE.

ABSTRACT OF
DR. LYLE W. R. JACKSON'S
LECTURE ON DISEASES OF THE PLANE TREE
AT THE
MORRIS ARBORETUM—JANUARY 11, 1936

DR. JACKSON pointed out that the plane trees used so extensively in city planting about Philadelphia are probably hybrid trees of foreign origin, known widely as the London plane. Our related native sycamore or buttonwood tree belongs to another species (*Platanus occidentalis*).

He stated that until rather recently the chief disease of planes occurring in this region is an anthrachnose, due to a fungus belonging to the genus *Gloeosporium*. This kills the leaves, and perhaps young twigs in the spring, giving the trees the appearance for a time of having been scorched. This disease is not immediately serious, but when repeated year after year, may cause important damage or even death.

About two years ago, a serious new disease was found in Upper Darby, Brookline, Beechwood, Ardmore and Drexel Hill, where it was taking a heavy toll of the plane trees. After a study, carried on by Dr. Jackson as opportunity has permitted, it seems clear that a fungus belonging to the genus *Ceratostomella* is responsible for the damage. Sparseness of the foliage, which assumes a yellowish color, is a symptom that grows with the progress of the disease, appearing usually two or three years before the death of the tree. Trunk lesions are seen as discolored areas of the bark, where infection has entered through frost cracks, damage from the hub of vehicles or other wounds. The surface of the wood under the damaged bark is blackened, the color appearing in fine, perpendicular lines that penetrate deeply into the wood along the sheets of cells known as the medullary rays. These rays seem to be the path along which the fungus invades the deeper tissues. Under the microscope these cells are seen to be occupied by the threadlike mycelium or body of the parasite, and in these tissues the spores, or reproductive bodies, are formed in countless numbers. These are able when freed to spread the disease to other trees having wounds that provide paths of entry such as wounds from pruning, wind damage, etc.

No lesions have been found by Dr. Jackson so far on buried roots, but surface roots that have been injured by wheels, or otherwise, show them.

Thousands of plane trees have died and have been removed from the streets of the Philadelphia suburbs named. No survey has yet been made to show how widespread the disease really is at this time. Although it is reported from Camden, it seems to be still a local trouble. A search of the literature by Dr. Jackson has not shown its presence elsewhere, nor indeed does the disease seem to have received scientific study before the work here reported.

How it got to this region, and where it came from, are unanswered questions. It seems likely that the disease began to work at Beachwood about six years ago. Its introduction may have taken place from six to eight or more years ago.

It was reported by Mr. S. N. Baxter, City Arboriculturist of Philadelphia, in the discussion following the lecture, that this type of plane tree was introduced into Philadelphia about thirty years ago by Mr. William Warner Harper, of the Andorra Nurseries.

From the information thus far reported, it seems probable that another destructive fungus disease has made its appearance in our neighborhood. It is virulent, it kills promptly, and our street trees and the native sycamores of the country offer abundant means of propagation. One asks with much concern whether another group of our trees is in serious danger. The past experience with the chestnut blight and the present struggle with the Dutch elm disease suggest that this study should be actively prosecuted in order that the existing situation may be known and protective measures undertaken to stamp out this disease while it has a limited distribution.

The work reported here was done by Dr. Jackson, Dr. Sleeth and associates in the Laboratory of the Allegheny Forest Experiment Station, conducted at the University of Pennsylvania, in co-operation with the Department of Botany.

Reported by RODNEY H. TRUE.

ARBORETUM NEWS

Mr. John C. Swartley, of the Arboretum Staff, enjoyed the facilities of the Herbarium at the Arnold Arboretum in October for a study of certain unnamed types of shrubbery found at the Morris Arboretum. In December he spent several days at the New York Botanical Garden working in the Herbarium there.

The courtesies extended by these institutions are greatly appreciated.

The Koster Nursery Company, of Bridgeton, New Jersey, has generously presented about 100 specimens of *Taxus* to the Arboretum.

The Arboretum has been enriched from time to time by the gift of rare hemlocks from the collection of Mr. Charles Francis Jenkins, at "Far Country." His bulletin is a welcome addition to the files of the Library.

WINTER LECTURE COURSE

February 8, 1936

DR. HARLAN H. YORK

Diseases of the Himalayan Pine and Other Ornamental Conifers.

Professor York is the head of the laboratory of Forest Pathology, University of Pennsylvania, and Pathologist to the Arboretum.

March 14, 1936

MR. HENRY TEUSCHER

Winter Injury and Hardiness.

Mr. Teuscher is Dendrologist at the New York Botanical Garden.

April 11, 1936

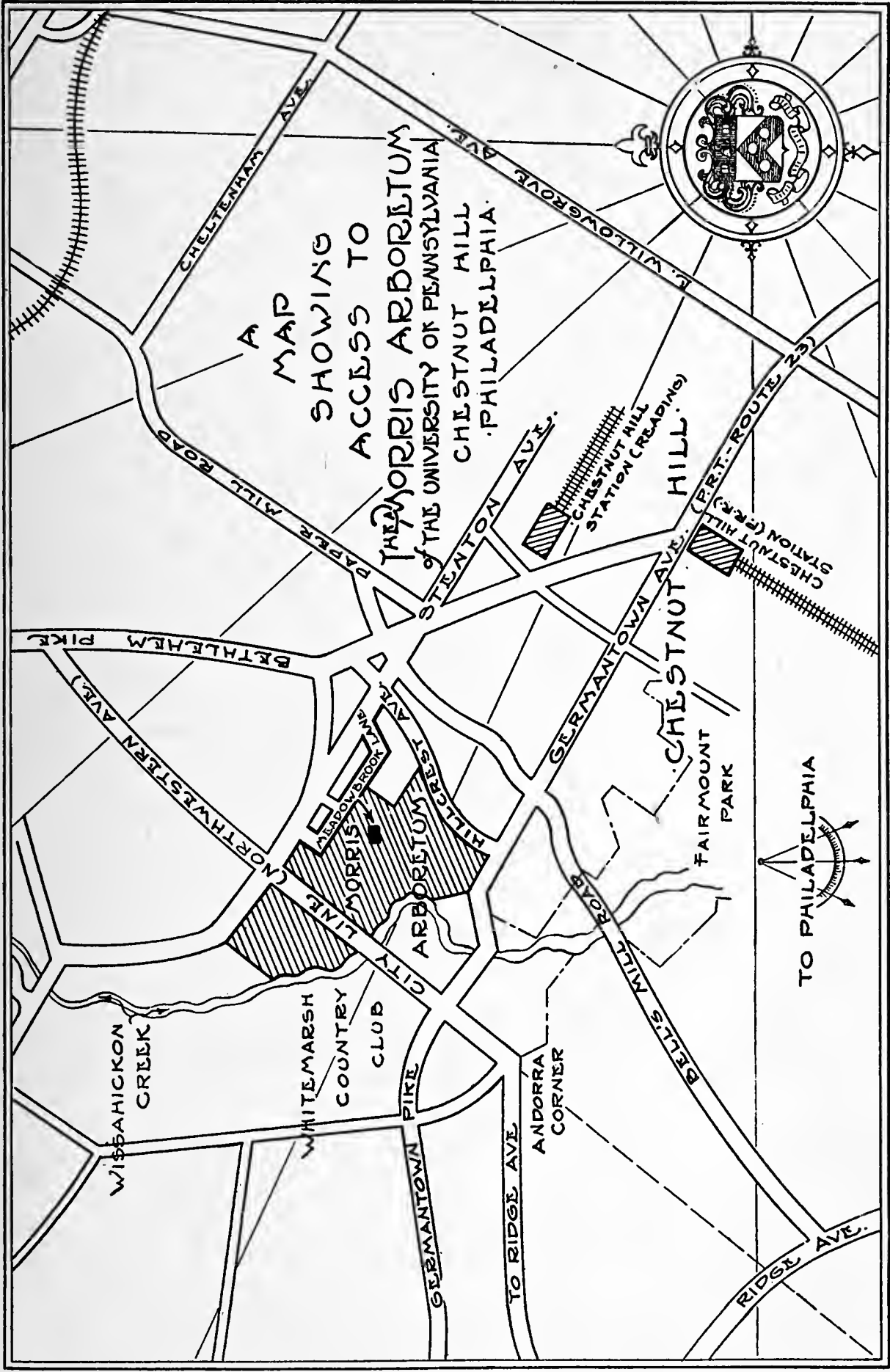
DR. WILLIAM CROCKER

Injury Caused by Illuminating Gas.

Dr. Crocker is Director of the Boyce Thompson Institute for Plant Research at Yonkers, New York.

These lectures will present the results of much specialized scientific research and will apply these results to practical problems.

Lectures come on the second Saturday of each month.





ARBORETUM BULLETIN
OF THE
ASSOCIATES

APRIL, 1936

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MORRIS ARBORETUM
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PHILADELPHIA, PA., U.S.A.

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THE
MORRIS ARBORETUM
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View at the Swan Pond

The illustration appearing in this number is a view at the Swan Pond, through which the East Brook flows.

On the left side of the picture are branches of the Japanese varnish tree (*Koelreuteria paniculata*), and, seen through it, the top of a Japanese black pine (*Pinus thunbergiana*). Rhododendrons appear at the water's edge.

The low growth on the island in the middle of the picture is made up of laurel and rhododendron. Above these spread the tops of a dogwood and a sorrel-tree (*Oxydendron arboreum*).

On the right of the stream are the large leaves of the umbrella tree (*Magnolia tripetala*) and the top of a European larch (*Larix decidua*).

In the middle background is seen the spreading top of a weeping willow.

RODNEY H. TRUE.

WINTER INJURY TO CONIFERS AT THE MORRIS ARBORETUM

A COLLECTION of uncommon conifers that had grown so well for many years at the Arboretum prior to the devastating winter of 1933-34 present interesting data, which should prove of some value in the future. As concrete examples of this use of information, gained by the wholesale killing of Boxwood during sub-zero temperatures, and the proven hardiness of the *Taxus* to withstand the same conditions, nurserymen have already substituted *Taxus* plantings for those of Boxwood.

It has been a common practice in Philadelphia and the adjoining territory, especially during the long period of mild winters, to plant such species of conifers as are of questionable hardiness and which border between hardy and semi-hardy in this vicinity. These plants have grown well and have been greatly appreciated by the growers, but it has been necessary to afford them winter protection in the form of corn fodder, boxes or similar materials. While it is mainly a matter of personal preference among the growers, it is the opinion of the writer that boxes or materials which permit free circulation of air throughout the plant have a tendency to eliminate injury caused by low temperatures or scalding from over-heating during warm, sunny spells.

During the winter in question, a four-foot plant of the Long Leaf Pine—*Pinus palustris*—which had been obtained from the South and planted the previous spring, withstood the rigors of the extreme cold with the protection of a wooden box, free from interior packing of any kind and lidless, to insure free circulation of air.

The most important factor in the elimination of winter injury due to low temperatures is to supply the proper environment in which the plant is to grow. While some may withstand low, moist positions, conifers as a rule prefer higher elevations, where a free circulation of air is assured, and a well-drained soil of acid reaction. This does not apply to species of Juniper and other swamp-loving forms. For the above reason it may be possible that some of the rare conifers killed during this winter were killed because of low elevation instead of cold. Under different environmental conditions, the injury may have been lessened or eliminated entirely in some species. Under these severe conditions, we have learned from observation that such species as the Atlas Cedars, which were not considered as hardy as they proved to be, can and did withstand the sub-zero temperatures. They have now withstood two such severe winters successfully.

The percentage of injury recorded in the following list of plants is based on the excessive and not the average burning or discoloration of foliage during the average winter injuries. An unofficial temperature of 17° below zero was recorded at the Arboretum. Although this may not be correct, it will serve as a basis for recording the approximate temperature the following species were subjected to.

The following species were well established plants, growing on low, moist ground in an open position, exposed to the west and southwest, and protected from

the north and east by tall windbreaks of oak and maple trees. The specimens had been given a protective covering of corn fodder before the extreme cold weather set in, and sufficient water to the root system.

***Cedrus deodara*, Laws, M489**

A healthy, vigorous, growing specimen, 12 feet to 13 feet high, was entirely killed by early spring.

***Cedrus deodara*, Laws, M397**

Growing quite near the above, the same size, age, and healthy condition, and having the same protection. The foliage remained green during the spring and until early summer, at which time the entire plant died. The stumps were allowed to remain until August, but no sign of recovery was indicated.

***Cedrus libanotica*, Link, M495**

Cedar of Lebanon. A strong, healthy specimen, completely killed by spring.

***Cedrus libanotica*, Link, M493**

Same condition and size as the above, 60% of the foliage remained green until July, when the plant died.

***Cedrus libanotica*, Link, M398**

Much larger and older tree than the two preceding specimens, but growing under the same conditions. No visible injurious effects were observed in the spring and summer, nor did any develop at a later date. This plant is still living after two such winters.

***Cryptomeria japonica*, D. Don., M368**

Foliage 100% killed in the spring. The branches were pruned back and the tree allowed to remain for signs of recovery, but none occurred.

***Cryptomeria japonica* Lobbii, Carr., M488**

Entire plant 100% killed by spring.

***Cryptomeria japonica* Lobbii, Carr., M499**

One small growth, having live, green foliage, remained until early summer. Entire plant destroyed.

***Cryptomeria japonica* Lobbii, Carr., M1054**

Much larger and older specimen growing among a group of conifers in a protected area, having the upper part of the tree exposed to sun and wind, and on slightly higher ground; 30% of branches and foliage was destroyed. There was a slight recovery and the plant is still living.

***Cunninghamia lanceolata*, Hook. M383**

A Chinese species considered less hardy than many of the foregoing specimens. An exceedingly strong, vigorous plant, 5 to 6 feet high and well covered with corn

fodder. When uncovered this was found to be completely killed, but one-year-old cuttings from this specimen, growing in a cold frame on high ground, with slight protection and being exposed to the south and southwest, did not receive the slightest injury.

***Libocedrus decurrens*, Torr., M497**

"Incense Cedar." Strong, healthy plant—was 100% killed by spring.

***Libocedrus decurrens*, Torr., M498**

Same size, shape and healthy condition, and growing under exactly the same conditions as the above—received a slight foliage burn only on west side of tree, but entire plant died some months later.

***Sequoia gigantea*, Decne., M384, M385 and M386**

Specimens of the Giant Sequoia, 5 to 6 feet tall. With the exception of slight tip injury, these were healthy plants, and well covered. They were completely killed, but 12 seedlings of the same species, 12 inches and 18 inches tall, growing on high ground in slightly protected cold frame, did not show winter injury other than discoloration of foliage.

***Cephalotaxus drupacea*, Sieb. & Zucc., M473**

Strong, healthy and bushy plant, growing on higher ground, away from the flat, open space of the preceding species on protected hillside having a south and southeast exposure. Vegetative growth 80% killed. During the following summer a few new growths developed on the old stems, but did not mature. The specimen eventually died at the base, from which a new top has developed.

***Cephalotaxus drupacea*, Sieb. & Zucc., M59**

Growing a few feet from the above and in the same healthy condition; same size and age. Entire growth killed to ground. After pruning, strong healthy branches developed from base of stump during summer. The following year this plant died from sub-zero temperatures.

***Cephalotaxus Fortunei*, Hook, M60**

Strong, healthy plant, growing under exactly the same conditions and exposure as the above. Received 90% growth kill. During the summer a few weak growths developed from the base, but did not mature.

The following species of the Atlas Cedars, the beauty and size of which are so much appreciated at the Arboretum, received no permanent damage from the severe low temperatures. Growing on a sunny hillside and protected from the north and northwest, and provided with good drainage, the usual browning of the foliage was slightly more pronounced, especially of the variety *glauca*. It is gratifying to report the degree of hardiness these valuable species exhibited, especially since they have been considered so much more tender. It has been suggested that the fact that the seed supply from which these trees were grown was gathered at a high elevation in the Atlas Mountains is responsible for their hardiness. This undoubtedly is a con-

tributing factor, but the selection of the site evidently supplied the proper environment for them. This collection includes: *Cedrus atlantica*, Manetti, M303; *Cedrus atlantica aurea*, M864, *Cedrus atlantica argentea*, Murr., M858 and *Cedrus atlantica glauca*, Carr., M1116.

***Taxus baccata fastigiata*, Loud., M54**

The Irish Yew, growing on a slight grade and protected from the north and northwest by a steep hillside and other tall vegetation, but exposed to the south. Healthy, large specimen received 70% killing of the branch ends. Recovery during the following summer nominal, and, due to internal structure injury, the plant died later.

***Taxus baccata fastigiata*, Loud., M140**

Same size and age as the above. Did not exhibit any external injurious effects, but was seriously affected by internal injury later and eventually died.

***Taxus canadensis aurea*, Hart, M1209**

Received 80% injury to individual growths. Two growths, each 6 feet high, did not show the slightest injury, and remained green the whole summer. A few weak growths developed, but no permanent recovery resulted.

With the exception of the two preceding species, it has been observed in the Arboretum that all other species and varieties of *Taxus* were unaffected by the severe winter conditions.

Other conifers growing in the Arboretum, which were uninjured by the severe climatic conditions of 1933-34, are represented by the Cedars, Cypress, Firs, Junipers, Larches, Pines (with two exceptions), Hemlocks and Spruces.

JAMES LAMBERT.



CONSERVATION OF TREES

PEOPLE WHO LIVE in cities sometimes have a hard time keeping in touch with Nature. They must leave home or go to the limited areas preserved as parks. An attempt to maintain a slender connection is seen in the trees planted along the streets.

I want to speak a word for those trees. They have a hard time of it, tough citizens though they must necessarily be. Their root systems are forced to grow under water-tight roofs of asphalt and concrete, and are forced into the presence of sewers, gas pipes, and other underground features that can give little help and occasionally much harm. Above ground, they are obliged to live in an atmosphere more or less man-tainted with coal smoke, industrial gases and particles of carbon that tend to block up the pores of their leaves, through which carbon dioxide escapes and oxygen enters. Sometimes, the insult becomes too much to bear and they languish and die.

The delivery horse, while waiting for the driver to leave his bottle of milk or loaf of bread, used to relieve the tedium by gnawing the bark of the street tree. The careless driver of the coal wagon still breaks or damages the lower branches of trees and lets fungi into the wounds, from which starting points the rest of the tree is invaded. As trees grow old, and larger, their bases push out nearer to the curb and are often damaged by the hubs of wagons and cars that knock off areas of bark. These areas, again, let in fungi that bring delayed destruction.

Sometimes, trees suffer because of well-meant efforts of friends. Heavy iron tree guards are sometimes set up around trees to protect them from the horse and other danger. In time the tree fills the guard, and unless the friend relaxes the pressure by opening it or by removing it, the guard cuts into the tree, sometimes quite or almost ringing it.

But, the danger is not over if the roots do find a source of water and minerals down under the street and sidewalk. Even if no horse gnaws off a patch of bark and no wind tears off branches, even though the coal cart has been mindful and the trees make a fine, rapidly-growing top, as they become taller another danger threatens them, and the better the growth, the greater is the danger. Some morning in late spring or summer, a gang of tree pruners comes into the street armed with saws and shears, and proceeds to cut the top off or take out part of it, leaving it a caricature of a tree, a misshapen, mangled thing, whose only offense was that it was in danger of reaching the wires. The street, after such a visitation, is a sad sight. The truck following the gang is full of tops and branches of trees that did too well. They are left with their untreated wounds inviting fungi to come, and after years of delay complete the ruin. It may not be known that an owner of trees has a right to forbid such operations.

So, we inconsistent humans, obeying a sane impulse to have shade and coolness and a bit of natural beauty, plant trees in cities. The trees struggle more or less successfully with bad root conditions and with man-made atmospheres, only in the end in many streets to suffer mangling from hasty gangs, who must keep the wires clear by the least troublesome and least expensive means. All cities do not do things this way, but one not far away does.

The city, having streets shaded in the summer by healthy trees, bordered in the fall with the gold and crimson of autumn, and beautiful in the winter with the stark but marvelous architecture of stems and bare branches, is a better place for us humans to live in than one lacking these things.

RODNEY H. TRUE.

(Delivered Wednesday, October 16, 1935, over Station WFIL—Strawbridge & Clothier Store—for the Council for Preservation of Natural Beauty in Pennsylvania.)

LATE WINTER BIRDS OF THE ARBORETUM

THAT curious and seldom observed bird, the Brown Creeper, *Certhia familiaris americana*, is most beneficial to such a place as the Arboretum or any locality where trees grow. It spends almost its entire existence minutely examining the crevices in the bark of the trunks and large limbs of trees in a never tiring search for insects, their eggs and larvæ. Starting at the base of a tree this bird ascends spirally until it reaches the first limbs where it may go a short distance along one but more commonly quickly dives in a gliding fashion to the base of an adjoining tree, there to repeat the performance. All year round this food is found in one form or another, and the diet is occasionally varied with pine seeds and the like.

Small and slim in appearance when compared with the English Sparrow, it is not usually seen by the casual person as its color pattern is protective and blends exceedingly well with bark. The upperparts are medium brown streaked with whitish and darker brown while the underparts are grayish-white and the seasonal and sexual differences in plumage are slight. This species is almost perfectly adapted to its environment and manner of living, not only by coloration but also structurally. The bill is slender, sharp and curved, all of which makes an excellent tool for probing and extracting; the claws are long, sharply pointed and well curved, producing extraordinary adeptness for clinging to and hitching up both rough and smooth types of bark; the tail feathers are rigid and pointed, serving as a prop in the bird's ascent and food searching much in the fashion of the woodpeckers. Its call note is thin, fine and lisping and quite inaudible to many people; in fact, those who are capable of hearing it must listen well to distinguish the sound.

The family of Creepers is represented in North America by only one species, which is divided into five subspecies, the Brown Creeper being the form found in this section of the country. It breeds in the Canadian and Transition Life Zones from southern Manitoba east to southern Quebec, south to Nebraska, Indiana, New York and along the Alleghanies to North Carolina. In winter it is to be found over a great part of its breeding range and south to Texas, Alabama and Florida. The nest is unique, as it is placed on the side of a dead or dying tree behind a piece of loose bark, and is composed of bark fibers, small twigs, moss, bits of wood and spider webs. Varying from five to eight in number, the eggs are white spotted and speckled with reddish-brown chiefly in a wreath around the larger end.

Though not present in this district during the Summer months, this bird is quite common throughout the duration of both the Spring and Fall migrations. In Winter it may be observed singly and in pairs wherever there are trees, and some years it is common at this time. Accordingly, the insects are destroyed in great numbers, as they are much in evidence at these periods in the form of either adults, larvæ or eggs. Through the colder months insects in the various stages of life are concealed in the crevices of bark, hence the diligent search made for them by the Brown Creeper. As far as known, the insects eaten are mostly those which are injurious to plant life and therefore this species is a very valuable assistant to the horticulturist and forester.

While endeavoring to find a mate, its delicate, pure and warblerlike song may be heard. During the Winter it is to be found in the company of Downy Wood-

peckers, Kinglets, Chickadees, and Nuthatches. Under most conditions it is a comparatively tame bird and ignores an observer unless a very close approach is attempted. Its tenacity has been proven by the fact that individuals have been discovered frozen to death with the small bodies still clinging to the bark.

Mallards have been seen again, whose wariness strongly suggested they were wild birds. A flock of Cedar Waxwings remained on the berry-bearing tree No. 305 until all of the fruit was consumed. The tree in question is on the highland by Hillcrest Avenue, *Phellodendron*, the Cork Tree, No. 969, is being visited by a great number of Robins, which are feeding on the berries which it bears. This tree is one of the group just to the north of the main building. Purple Finches were found eating the berries on the native Holly and also the buds on the trees to the rear of the boathouse.

The following species were added to the list during the period from the middle of December, 1935, to the eighth of March, 1936.

Great Blue Heron—*Ardea herodias herodias*

One seen along the mill creek on the farm.

Sharp-shinned Hawk—*Accipiter velox velox*

One seen diving into a flock of small birds in the orchard. The chase was unsuccessful.

Killdeer—*Oxyechus vociferus vociferus*

This species was found in numbers on the low wet places about the farm.

Northern Flicker—*Colaptes auratus luteus*

One located near the main building. Will undoubtedly be common in a short time.

Eastern Robin—*Turdus migratorius migratorius*

Coming through in large flocks and from now on will be common.

Eastern Golden-crowned Kinglet—*Regulus satrapa satrapa*

Only one seen, which was rather surprising.

Eastern Meadowlark—*Sturnella magna magna*

One seen and heard singing in a tree on the farm meadow, where many should shortly be in evidence.

Purple Grackle—*Quiscalus quiscula quiscula*

Now coming through and roosting in large flocks. A number will no doubt breed.

Eastern Purple Finch—*Carpodacus purpureus purpureus*

Six appeared in pairs, all in Compton.

Eastern Field Sparrow—*Spizella pusilla pusilla*

One observed in tree by duck pond. Should be common in a short time.

LEWIS MACCUEN SMITH.

DISEASES OF THE HIMALAYAN PINE

ABSTRACT OF LECTURE BY

PROFESSOR HARLAN H. YORK

DELIVERED AT THE MORRIS ARBORETUM—FEBRUARY 8, 1936

INJURIES resulting from low temperature are of common occurrence among woody plants when the right conditions prevail. Some of the conditions which predispose to injury are: Uncongenial environmental factors, such as drought, lack of necessary food materials, and improper aeration of the soil. Thus, what may appear to constitute winter injury may be only a secondary effect; hence, it may often be exceedingly difficult to diagnose so-called "winter injury."

Injuries from low temperatures, even though slight, may often become places for the entrance of parasitic fungi into the plant. As a matter of fact, any sort of injury in the outer covering of a tree constitutes an avenue of infection for various parasites.

The winter of 1933-34 was extremely severe on our woody ornamental plants, especially those of foreign origin. Conspicuous among these was the Himalayan pine, *Pinus excelsa*, one of the most beautiful pines in the world. It had seemed to show splendid adaptability to various types of soil around Philadelphia, Baltimore, Washington, and other cities. Hundreds of these trees have died. Many inquiries have been received about this disturbance and what steps should be taken to save the remaining trees.

It seems to be common belief that the loss of the Himalayan pine is due primarily to winter injury. In his investigations on the Himalayan pine disease in Chestnut Hill and other suburban sections around Philadelphia, the speaker has found comparatively few trees which appeared to have been killed outright by the extreme cold. It was evident in the vast majority of cases that some factor other than "winter injury" was directly responsible for the death of the tree and for certain diseased conditions of trees yet living. A brief summary of some of the results of the speaker's investigations shows that young trees which were apparently in a vigorous, thrifty condition were not injured, or only slightly so. The finer roots, especially the mycorrhizal, or "feeding roots," of the injured trees were dead, or in a very poor condition. The soil around these trees was very compact, a condition highly unfavorable to aeration, and was low in essential nutrient materials. The rainfall during the latter half of the summer and fall of 1933 was so scant that the ground became quite dry to a depth of several inches. Severe winter injury is often preceded by such summer conditions.

Winter injury, as observed in the Himalayan pines, usually resulted in the killing or weakening of the tissues of the inner bark of the tree. These injuries were often more or less localized as patches of varying areas. Injuries of this sort in many cases were more common on the south to the southwest side of the tree. Winter injuries of this type are really wounds, which are readily entered by various organ-

isms, especially parasitic fungi, which may invade and kill the uninjured tissues of the inner bark, ultimately causing the tree to die.

Mr. John A. Jump, graduate student at the University of Pennsylvania, in his investigations at the Morris Arboretum, is finding that some of these parasitic fungi may attack other exotic pines, which apparently have not been winter-injured.

Among the various fungi which have been isolated from lesions caused by frosts and winter injury is one which seems in many cases to become parasitic in the inner living bark. This organism has been identified as *Sphaeropsis malorum*. In its form it shows a striking resemblance to a fungus which is parasitic on the leaves and stems of the apple tree. The *Sphaeropsis*, which attacks the Himalayan Pine, was isolated from trunk cankers on *Pinus monophylla* and from lesions on large branches of *Pinus cembra* and *Cryptomeria japonica* in the spring of 1933. It was also found on the main stem of a Himalayan pine and a branch canker of the Austrian pine in the fall of 1933.

Mr. Jump inoculated one-year-old seedling Himalayan pines in the greenhouse at the University of Pennsylvania with *Sphaeropsis malorum*, which he isolated from the diseased bark of a large Himalayan pine at the Morris Arboretum, and which was severely injured by freezing in the winter of 1933-34. He has found that this fungus is capable of living in the outer dead tissues covering the stems and producing its fruiting bodies. Apparently, the inoculated seedling Himalayan pine trees so far have not been injured.

From these experiments and various investigations, it seems that *Sphaeropsis malorum* may live in the outer dead bark of various conifers, lurking around, so to speak, biding its time until the living tissues of the bark are injured or weakened, and then invading with deadly effect.

In conclusion, it appears that if we knew how to maintain a congenial environment for the Himalayan pine, as well as for other woody plants, the hazards of winter injury would be greatly lessened.



HARDINESS, WINTER INJURY AND WINTER PROTECTION

ABSTRACT OF LECTURE GIVEN BY

MR. HENRY TEUSCHER

Dendrologist of the New York Botanical Garden

SATURDAY, MARCH 14, 1936

THE COMPLICATED NATURE of the problem of susceptibility to winter injury was pointed out. In general, conditions arising from whatever source or sources that result in a lowering of the vitality and vigor of the plant make it the more liable to damage by low temperatures.

The nature of the processes worked out in frozen plant tissues was briefly discussed. The formation of ice crystals between the cells making up the plant structures, the mechanical injury that the formation of these crystals may cause to the cells, the concentration of the cell solutions due to the withdrawal of water in the formation of the ice crystals, were indicated as possible causes of direct damage. A great variety of causes tending to increase susceptibility through the lowering of the general level of vigor was indicated, and among these causes several matters of practical handling were pointed out.

1. Late cultivation of the ground, inducing growth so late in the season as to cause the production of tender, unripened wood that cannot resist low temperatures.

2. Late fertilization, or over-fertilization, especially with nitrogenous fertilizers producing a like result.

3. Poor drainage, especially in rich soils, causing a soft, sappy growth that suffers from frost. This tends to produce injury to flower buds, as in Forsythia.

4. Summer drought followed by new growth late in the season. Conifers and other evergreens that have suffered from severe drought during the summer may be beyond hope in the fall, with signs of sudden death appearing the following spring.

5. Mulching with moisture-holding or air-excluding litter may easily lead to the rotting of the flowers of perennials. Alpine plants are especially liable to injury from this cause.

6. Too vigorous summer pruning may lead to late growth and under-ripened wood.

7. The production of a heavy crop of fruit may exhaust the plant and reduce its resistance to cold.

8. Plants may be put in locations giving wrong exposure to sunlight and wind. Bad root drainage may reduce resistance. Planting in "frost holes" where cold air settles may lead to loss.

9. Some plants need protection when young and die when unprotected. If protected for a time they early become cold resistant.

10. Neglect to lift, divide and replant perennials often enough to keep them vigorous and young.

With so many causes of such great variety operating to influence the ability of plants to resist injury from cold, it is clear that the cause of loss in any particular instance may be sought in the innate susceptibility of the plant, such as a tropical plant in a frosty climate, or it may be sought in one or more of the many possible contributing causes arising from the site of planting, application of fertilizers, pruning, fruiting, drought, and from other methods of handling in a great variety of ways.

NORTH AMERICAN PITCHER PLANTS

THE SMITHSONIAN INSTITUTION has just published a work on the North American Pitcherplants, by Mary Vaux Walcott, Edgar T. Wherry and Frank Morton Jones. This is in the form of a quarto-size portfolio, comprising fifteen magnificent, colored plates, faithfully copied from Mrs. Walcott's full-size water color paintings of the eleven known species and subspecies, and four interspecies hybrids. Each plate is accompanied by a brief descriptive text, prepared by Dr. Wherry, giving data as to the discovery of the species and remarks as to its noteworthy features.

There is also included a 34-page booklet containing an article entitled "Distribution of the North American Pitcherplants," by Dr. Wherry, together with a most fascinating account of Pitcherplants and their Insect Associates, by Dr. Jones.

The distribution maps are more complete and accurate than any previously published, being based not only on the specimens preserved in herbaria, but also on many weeks of field work. This was made possible by the kind support of the late Mr. Louis Burk, and the specimens obtained in the course of these trips are now, as has already been noted in the Arboretum Bulletin, the property of the Morris Arboretum. Dr. Wherry is Ecologist on the Arboretum staff.



PROTOPLASM

By WILLIAM SEIFRIZ

Professor of Botany, University of Pennsylvania

569 pages, 6 x 9, illustrated, \$6.00

THE MYSTERIOUS SUBSTANCE called "protoplasm," Huxley's "physical basis of life," has been intensively studied by many kinds of investigators since its great significance was first recognized.

In a recent book, Professor Seifriz, a member of the Department of Botany in the University of Pennsylvania, has brought together for the first time all of the physical, chemical and biological methods and principles that are known to bear on the properties and behavior of protoplasm.

This book deals broadly with biophysics in its various relations to the branches of science that contribute to the investigation of the biological problems involved. The many chapters making up this book deal with the various technical details that are involved in the study of protoplasm.

THE ARBORETUM AT THE FLOWER SHOW

LAST SPRING the Arboretum accepted the invitation of the Pennsylvania Horticultural Society to make a modest educational exhibit at the annual Flower Show. The invitation was repeated this year, and the Arboretum showed the Burk collection of Bromeliads, purchased and presented to the Arboretum by Mr. Wharton Sinkler. These highly-colored epiphytes are found growing on the large branches of trees in rainy tropical forests. They carry on their entire life history high among the dripping tree tops. Their more familiar and less striking relatives—the so-called “Florida Moss”—that festoons the trees in the South, and the terrestrial Pineapple were also shown.

An educational exhibit of plants representing the chief types seen in the ascending scale of plant development was shown: The water-living *algae* (pond scums, brooksilks, etc.); the fungi, living sometimes as parasites, and often as saprophytes on decaying wood and other vegetable matter; the liverworts, the mosses; the ferns in their young prothallial stage and in the familiar mature stage, the horsetails and other fern relatives, the cycads, the gymnosperms—cone-bearing evergreens—the monocotyledonous flowering plants and the dicotyledons, with their netted-veined leaves, were all represented.

One of the important soil constituents used by green plants is phosphate. A color test, demonstrating the phosphate content of soils, was exhibited, and tests made on soil samples brought in by interested persons.

The recently investigated fungus pest, so fatal to plane trees in the vicinity of Philadelphia, was shown by Dr. L. W. R. Jackson, of the Allegheny Forest Experiment Station, associated with the Botany Department of the University of Pennsylvania. Dr. Jackson's work has revealed the organism causing this disease. (See abstract of his lecture in Arboretum Bulletin No. 2, page 22.)



WINTER LECTURE COURSE

April 11, 1936

DR. WILLIAM CROCKER

Injury Caused by Illuminating Gas.

Dr. Crocker is Director of the Boyce Thompson Institute for Plant Research at Yonkers, New York.

This lecture will present the results of much specialized scientific research and will apply these results to practical problems.

ACKNOWLEDGMENTS

The Arboretum has received and acknowledges with thanks the following plants donated by the persons and institutions named:

Allegheny Forest Service

495 Plants of Western Conifers sent from Portland, Oregon

Ambler School of Horticulture

2 Species of Sequoia

Arnold Arboretum

3 Deciduous Trees and many seeds

Edward Auten, Jr., Princeville, Illinois

4 Peony Plants

Mrs. P. P. Calvert, Cheyney, Penna.

6 Plants of Sorbaria sp.

1 English Ivy

Conservation Department of New York

270 Plants of Pinus strobus and Pinus resinosa for research mainly

Hunnewell Estate, Wellesley, Mass.

Cuttings of 14 Taxus varieties (forms)

Outdoor Arts Company, Flourtown, Pa.

Many conifer cuttings—12 varieties

Oxford Paper Company, Rumford, Me.

60 Hardwood Cuttings of 10 varieties of commercial paper poplars.

Pennsylvania State College

12 Seedlings of Planera aquatica

Mrs. Samuel P. Rotan, Chestnut Hill, Phila.

1 Cedrus deodara plant

Mr. Edward Rosenbluth, Wallingford, Pa.

67 Plants of Iris (six varieties)

Mr. Maurice Bower Saul, Rose Valley, Moylan, Penna.

Coniferous Evergreens

Mrs. Charles H. Stout, Short Hills, N. J.

1 Chinese species of *Salix*

U. S. Department of Agriculture, Bureau of Plant Industry, Washington, D. C.

253 Deciduous and evergreen trees and shrubs and tender greenhouse plants

Mr. John C. Wister, Germantown, Phila., Pa.

60 Varieties of Lilac Scions, 35 species

The Arboretum has received valuable plants and cuttings by exchange with the following persons and institutions:

Ambler Nurseries, Ambler, Pa.

29 Evergreen and deciduous shrubs, some perennials

Fairmount Park Commission

8 Seedlings of deciduous trees

Koster's Nurseries, Bridgeton, N. J.

220 Conifers and 40 Rhododendron Hybrids

Masonic Home, Elizabethtown, Pa.

57 Evergreen and deciduous plants.

New York Botanical Garden

120 Evergreen and deciduous plants.

Hardwood cuttings from which 750 plants were grown

Mr. Maurice Bower Saul, Rose Valley, Moylan, Penna.

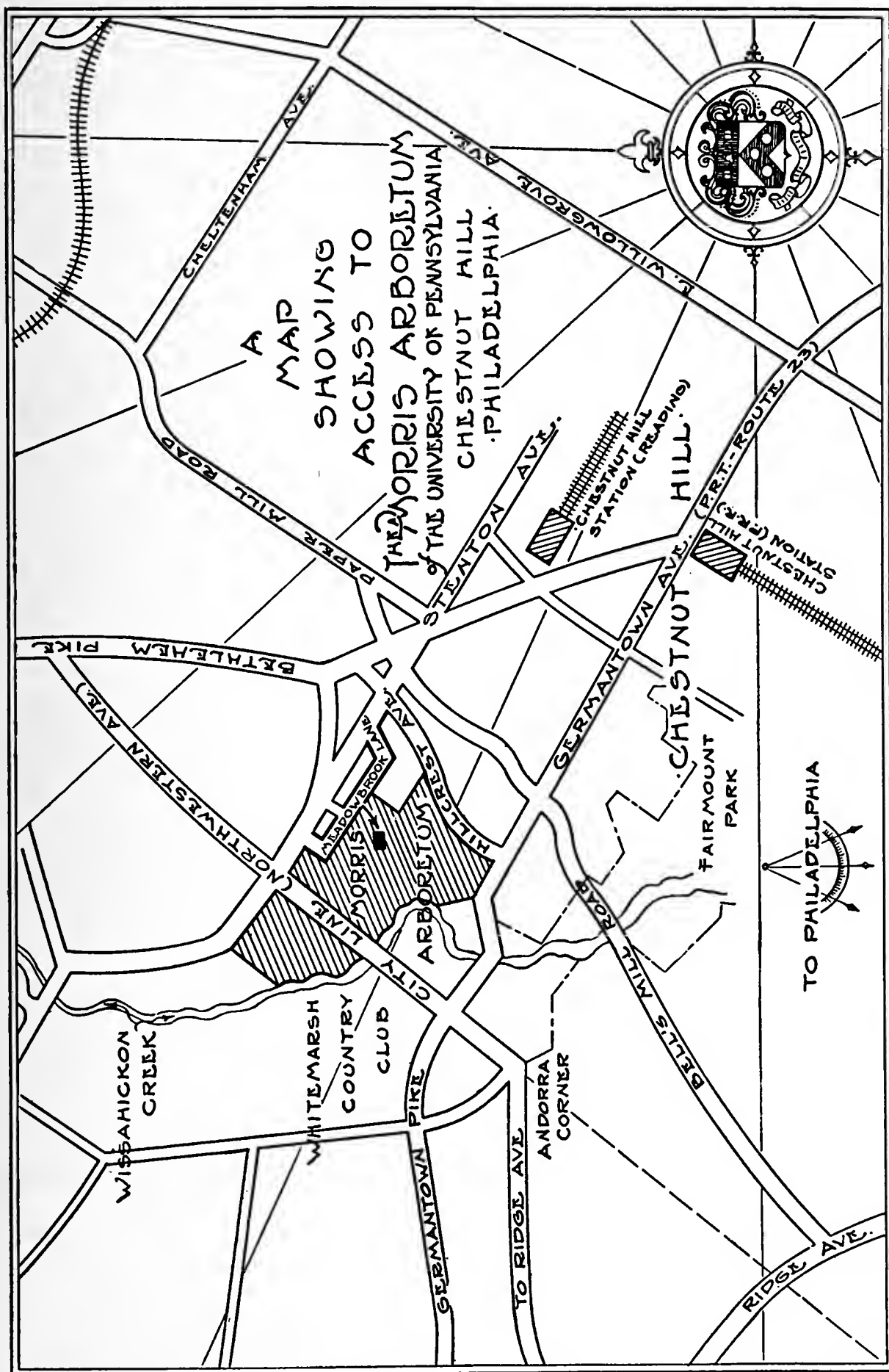
69 Evergreen and deciduous trees and shrubs

Swarthmore Arboretum, Swarthmore, Pa.

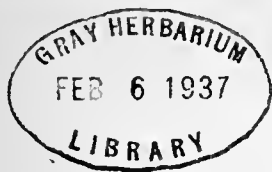
89 Deciduous and evergreen trees and shrubs and some seeds

Towson Nurseries, Towson, Maryland.

78 Evergreen deciduous trees and shrubs, including grafted *Pinus excelsa zebrina*







ARBORETUM BULLETIN
OF THE
ASSOCIATES

JULY, 1936

THE
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OF THE
UNIVERSITY OF PENNSYLVANIA

VOL. I. No. 4

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MORRIS ARBORETUM
CHESTNUT HILL
PHILADELPHIA, PA., U.S.A.

THE MORRIS FOUNDATION
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THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA



View in Japanese Garden

The illustration shows the Mansion in the far background, in which are the offices, herbarium and laboratories.

In the foreground at left is an azalea, leafless. Coming into the picture at the left is a part of the top of *Cephalotaxus drupacea*, the Plum Yew, at right of this on the path, *Juniperus excelsa stricta*, and blocking the view in the background is *Juniperus virginiana elegantissima*, gold tip Red Cedar. At the right of the path in the middle of the picture is *Pinus Cembra*, Swiss Stone Pine, with the loosely spreading top of an unnamed pine at the right of the view. The bare top of a tall walnut, now leafless, is seen in right background between the pines just named.

RODNEY H. TRUE

THE TENT CATERPILLAR

IN APRIL AND MAY, in eastern Pennsylvania, many wild cherries, apples and other trees of the rose family bear conspicuous silken nests of the Tent Caterpillar. These structures are the work of a community of hairy caterpillars hatched in March or in early April, a few days before the opening of the leaf buds of the infested trees, from eggs laid in the preceding summer.

The eggs are deposited in the form of sleeve-like masses surrounding small twigs. Each sleeve may be one-half to three-fourths of an inch in length and consists of 150-300 eggs, tightly fastened together and to the twig, and whose outer surface is more or less shiny. In winter, when the twigs are bare, these sleeves, or "egg belts," are easily seen, but at other times the foliage is apt to conceal them.

Each caterpillar, when just hatched, is about three-sixteenths of an inch long and nearly black. If the weather be not too continuously cold or wet, the caterpillar becomes full grown in forty days, more or less, having then reached a length of two to two-and-one-half inches. This growth is accompanied by a series of four moults, or sheddings of the outermost covering of the body, previous to the spinning of a cocoon. After each moult there is some change in the coloring, and after the fourth moult there is a white stripe along the middle of the back, and a row of blue and deep velvety black spots each side thereof.

The nest is begun about two days after hatching, if food in the form of young leaves be present. It is increased by the activities of the caterpillars which, pouring forth liquid silk from the floor of their mouths, produce first threads, then layers, of silk. The nest serves as a shelter from unfavorable weather and as a place in which to shed the skins. It increases in size as its occupants become older and larger.

The caterpillars leave the nest from time to time to seek and devour the leaves of the tree or bush in which the nest is placed, but return to it at more or less regular intervals. The feeding periods are usually three per day: at about 7 in the morning, in the early afternoon and, the longest, beginning in the early evening and extending into much of the night. As the leaves near the nest are consumed, the caterpillars naturally must travel longer distances. Their eyes are very small and probably have a low-grade efficiency of vision. To assist itself in finding its way back to the nest, each caterpillar blazes its way by laying down a continuous silken thread on the surface of the branches and twigs over which it travels. Should the foliage of the tree containing the nest be exhausted before the caterpillar's growth has been completed, the insect must seek food on nearby trees, so that the guiding paths then extend down the home trunk to the ground and over it to the next shrub or tree visited. Sometimes a new nest or tent is built on another tree.

Their regular goings-out and comings-back to the nest continue until after the

fourth moult. Then a new impulse appears. The caterpillars forsake their nest and their companions, disperse, wander, no longer leave their silken trails behind them, and each spins a silken cocoon around itself. These cocoons are located in protected situations, as under projecting bits of bark, in little cavities on stone or wooden surfaces, under ledges on buildings. A characteristic of the cocoons of the tent caterpillar, which one can't fail to notice in pulling them down or tearing them open, is the fine sulphur-like dust which is lodged in their walls.

Within the cocoon, after forty-eight hours, the caterpillar moults for the fifth time and now assumes the different form of a *pupa*, a non-feeding and, in this case, a non-moving stage. The sixteen legs of the caterpillar have apparently disappeared, but a closer examination reveals that the six forward ones are still present, but soldered down tightly to the surface of the body. Soldered down, too, are the wings and the feelers of the future moth. The wings previously had not been visible, while the feelers are much enlarged from the almost microscopic organs of the caterpillar.

For about three weeks the pupa remains in the cocoon. Then the final moult occurs, and from the dried pupal "skin" there issues a moth with reddish-brown or buff wings. The moth makes its way out of the cocoon, and soon spreads its wings to an expanse of about one and one-quarter inches. Each fore wing is crossed by two parallel, oblique, whitish lines. The body is hairy and three-quarters of an inch long. The male is a little smaller; his feelers are distinctly feathery, whereas those of the female are less so.

The moths of this species, and of many others, do not feed, their mouth parts never develop sufficiently for this function. Their lives, therefore, are brief, although some are reported to live a week. This portion of their existence is devoted to the production of the next generation. They pair and fertilized eggs are laid by the female two to three days after she has left her cocoon. She places these eggs in the sleeve-like mass described in the second paragraph and the cycle begins again. This occurs in June or July.

This brings us to a remarkable feature of the life history of the Tent Caterpillar. Most insect eggs laid in the first half of summer develop and hatch in a few weeks, with the result that there are at least two broods or generations in twelve months. The eggs of this moth develop, even as far as the caterpillar, during the summer, but ordinarily do not hatch until the following spring. The summer temperatures apparently do not affect them as many other insects are affected, so that there is but one generation of Tent Caterpillars per year. The explanation of this lies, perhaps, in some deep-seated peculiarity in the nature of the species.

The most wide-spread human interest in the Tent Caterpillar is probably that concerning its possible destruction, or at least diminution in numbers. The solution of all such problems must be based on a knowledge of the life-history of the

creature involved. The preceding sketch of the development of the Tent Caterpillar indicates as the most vulnerable points in its career: (1) the living egg-masses on twigs exposed to view during the leafless part of the year; (2) the nests or tents with the young caterpillars within them in the late mornings of April and May; (3) the cocoons with the potential egg-layers in June. These are stages which can be collected with ease and burned, destroying actual or potential individuals *en masse*. Foliage sprayed with arsenicals, of course, kills caterpillars which feed upon it, but this mode of attack is more expensive of both time and material, and the destruction wrought is relatively less.

The Tent Caterpillar, *Malacosoma americana*, is the topic of a number of publications of the United States Department of Agriculture, such as Farmers' Bulletin No. 662, of the extensively illustrated Bulletin No. 120 of the Pennsylvania Department of Agriculture, by Prof. N. F. Davis, of Bucknell University, and of an account by R. E. Snodgrass, in the Annual Report of the Smithsonian Institution for 1922.



MYCORRHIZAE OF TREES AND SHRUBS

K. D. DOAK

United States Department of Agriculture

Division of Forest Pathology

THE symbiotic union of roots of trees and shrubs with certain fungi of the soil results in the root-fungus organs called mycorrhizae. Their wide-spread occurrence in the plant kingdom has led to extensive investigation of the nature of this association. Although the structural relations of plant root and fungus are well known, the physiological action, especially growth influences of one upon the other have been determined with difficulty.

The morphology of fungus-roots or mycorrhizae has been studied in sufficient detail to divide them into two general types: (1) ectotrophic, in which the fungus develops only outside the plant root and between its cells, (2) endotrophic, in which the fungus develops only inside cells of the plant root. Among the trees, beeches, oaks, elms, pines, and spruces possess the ectotrophic form whereas maples, ashes, yellow poplar, and cedar possess the endotrophic form. These forms prevail consistently throughout the native growth range of each species. The lack of intergrading forms indicates that the development of mycorrhizal associations has progressed over a long period of time and reached a condition of relative stability.

It is proven that transplantation to new habitats for the species does not influence the type of mycorrhiza produced, if it is produced at all, and that inter-

mixing of species does not change the fungus-root habit of any plants entering into the mixture. Cultivation practices which place a species under entirely new growth conditions due either to fertilization or soil qualities does not appear to change its mycorrhizal habits. Certain soil fungi producing mycorrhizae may not exist under conditions where trees are planted but there are still sufficient numbers of the closely related fungus species present and capable of producing mycorrhizae. Experimental proof has been obtained to demonstrate that several soil fungi can form mycorrhizae with the same plants. Most shrubs show types of mycorrhiza similar to those of trees and the inter-relations between these, especially when interplanted with trees, has been perplexing. Most soils contain fungi capable of forming mycorrhiza of trees and shrubs even after long periods of cultivation and growth of field crops.

THE FUNGI-FORMING MYCORRHIZAE

The Agaricaceae or gill fungi, Boletaceae or fleshy tube fungi and the Gasteromycetes or puff-ball fungi have been proven mycorrhizal experimentally. Fungi other than these are concerned often in the endotrophic forms of mycorrhizae of some trees, and this association appears consistently for members of the genera *Acer*, *Fraxinus*, *Liriodendron* and *Chamaecyparis*. Proof of the connection between the endotrophic forms of the fungi concerned has not been obtained, but the morphology of the fungi themselves within the root tissues has been sufficient to establish that certain Ascomycetes or cup fungi and Phycomycetes or water molds are concerned. It appears that nothing other than isolation and experimental proof can make certain regarding the species of fungus or the type of mycorrhiza to be expected even when most of the forms existing within a given area seem to hold constant regardless of the intermingling groups and the treatment given the soil. Fertilization was at one time thought to be responsible for changes in the root habits of many trees through action on the soil fungi which form mycorrhizae, but under controlled conditions it has been found that nutrition was not responsible for any change in form of mycorrhiza morphologically. However, modification of the root habit in such manner that depth of growth is changed may be responsible for certain increases or decreases in amount of mycorrhizae produced, and the relative activity of various species of fungi.

THE HOST PLANTS

Although a small proportion of the trees and shrubs known throughout the world have been reported mycorrhizal in the literature, there appear few exceptions wherever critical examinations were made. Future investigations will reveal that most of them are mycorrhizal. The species represented are found in almost every family and genus. Up to the present time 178 Gymnosperms and 997 Angiosperms have been reported, and of these 44 Gymnosperms and 74 Angiosperms are represented by living specimens in Morris Arboretum are included.

RELATIONS OF MYCORRHIZAL FUNGI TO ROOT TISSUES

The intimate connection between mycorrhizal fungi and the external tissues of roots which they attack have been studied since 1829. Actual evidence that fungus threads can live in contact with the nuclei of the cells of a root has been obtained, and in many cases secondary development of the fungus after apparent absorption of the original growth of hyphae following digestion indicates that the higher plant is able to weaken the attack of the fungus with regularity. Among the ectotrophic forms the fungus is never overcome by its host. Here the existence of the two unlike organisms continues until some external condition influences the balance to the extent that both organisms perish together. In rare cases where the fungus develops both ectotrophically and endotrophically it is questionable whether the associations related are constant. Certain fungi seem to show an affinity for cells of root tissues under every condition of growth; for example, the fungus developing endotrophically within the cells of the roots of Yellow Poplar (*Liriodendron Tulipifera*) never produce characters of the ectotrophic form such as surface growth on the roots and an extensive system of hyphae between the walls of the cells as in the ectotrophic forms. Other cases of association indicate that the fungi are not always to be found with the same habits for any two species; for example, *Boletus granulatus* forms with White Pine a mycorrhiza showing distinctly different characters from that of *Boletus brevipes* whereas *Boletinus pictis* produces a form of mycorrhiza indistinguishable from that with *Boletus granulatus*. On the other hand, *Scleroderma vulgare* apparently develops a more extensive system of hyphae between the cells of its hosts than any other fungi studied experimentally. These differences in individual species are sufficient to indicate that the morphology of a mycorrhiza is entirely dependent upon the reaction of a specific host tissue to a single invading fungus.

These interrelationships of dissimilar organisms are almost entirely unknown especially where more than one organism is concerned in mycorrhiza formation on the same higher plant species. It is most significant to relate ecological differences found between soil organisms and their action on roots that proof of the mycorrhizal fungus is supplied. Tree roots show generally distinct habits when grown in different locations; that is, those with a deep rooting habit under forest conditions may produce many surface laterals when heavily fertilized or watered in a mineral soil. Planted trees and shrubs are usually grown under conditions where the fungus flora is either modified or entirely changed by soil treatment, but good evidence indicates that even under such conditions the same forms of mycorrhizae are prevalent.

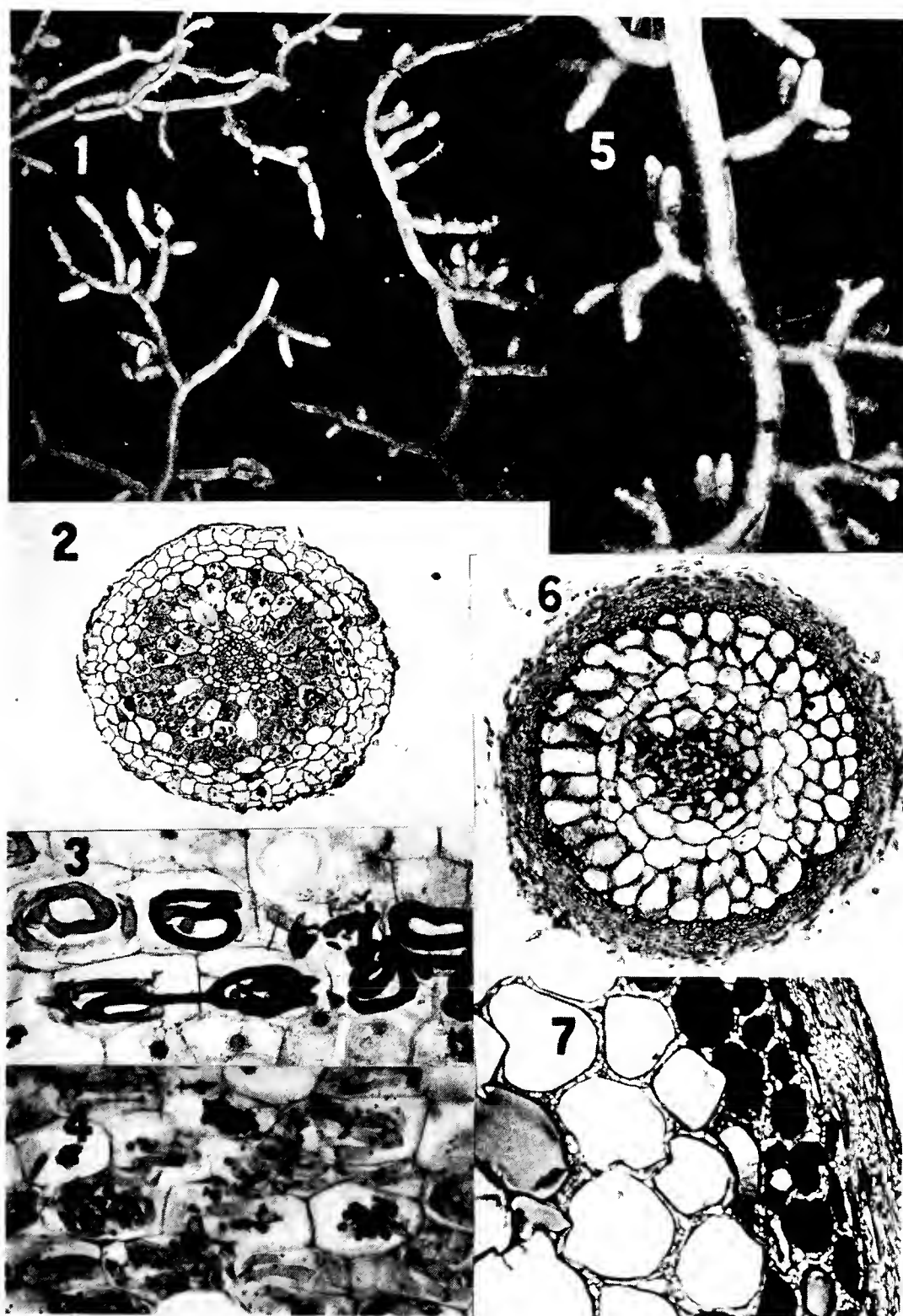
RELATION OF MYCORRHIZAE TO GROWTH

None of the experimental evidence has given proof that mycorrhizae can be strictly beneficial or detrimental under a wide range of conditions. Experiments

conducted over a period of years under single uniform conditions indicate that for a given species of fungus and host the mycorrhizae are strictly non-pathogenic or not so injurious as to produce a condition of disease. Under some conditions they may be beneficial to the growth of the tree or shrub and still others the detrimental effect is equally great. These same fungi with other hosts may influence growth in an opposite manner, for example, *Boletus bicolor* is distinctly detrimental to growth of White Pine under conditions where an adequate supply of mineral nutrients is available, whereas under the same condition *Amanita muscaria* seems to show some beneficial effect. These two species of fungi, when grown with the same host supplied only with forms of nitrogen not directly utilized, benefit growth almost equally under controlled conditions.

The growth factors concerned in a mixed plantings where attempts are made to regulate the growth of more than one tree by a single treatment of the soil can not be expected to favor the fungi on all species equally. A similar situation prevails when shrubs are not handled in a manner which will benefit the growth of associated tree species, and the problem becomes more complex as the number of species increases. It is evident that more knowledge of the growth factors for combinations of mycorrhizal fungi must be obtained before even a beginning can be made in recommending treatments that will be adequate for a large number of trees and shrub species have intermingled roots. The interaction of many dissimilar organisms is too complicated to analyze, but after the limitations in number of fungus species are better known it may be possible to change the soil treatment program to benefit both.

Absorption of mineral nutrients as it occurs through a mycorrhizal mantle has been found influenced by more and different factors than direct absorption through the cortex of a root. The water absorption of trees possessing ectotrophic and endotrophic mycorrhizae may also be changed but, as is the case for mineral absorption, plants for experimental comparison free from mycorrhizae are not available under natural conditions. Mycorrhizae possessing the ectotrophic mantle or sheath covering the roots seem to absorb water from humus under forest conditions as readily as some of the types of mycorrhizae possessing no surface growth of the fungus. When the habitat for either of these same species of tree is changed, the fungi seem to react in other ways, that is, the one concerned in formation of the extotrophic mantle will be increased in growth by reduction in amount of water absorbed whereas that forming the endotrophic mycorrhiza is decreased due to the absorption of more moisture from the cells it occupies within the root. The entire problem of determining where the balance between mycorrhizal fungi and higher plants lies will require many years of intensive study, but the fact remains that it represents one of the most widespread forms of living together or symbiosis in the plant kingdom.



Mycorrhizae of Tulip Poplar (*Liriodendron Tulipifera*) (1). These are endotrophic and appear as swelled root tips. When seen in microscopic cross section (2), the fungus coils occupy large cells near the center of the root but outer cells are infected and the root is not surrounded by a fungus sheath as seen in (6) a cross section of the ectotrophic form (5) of White Pine (*Pinus strobus*). Enlarged 360 times the development of the endotrophic form inside the cell walls (3) and with clumps of digested fungus threads or hyphae (4) is shown in comparison with the ectotrophic form (7) where the threads or hyphae penetrate only between the cell walls.

WINTER INJURY TO MISCELLANEOUS TREES AND SHRUBS

THE FOLLOWING ACCOUNT deals with damage that may be fairly laid to the severe winter conditions of 1933-34, neglecting the results likely to be due to disease, insects, storms and other natural agencies.

The effects of low temperatures were found in certain species to be more severe in old wood than in young wood; in others, the reverse was observed. In some instances, the flower buds were seen to be more susceptible to injury than the vegetative buds; in others, the opposite was seen. Of course, healthy plants, growing in favorable conditions, as a rule, were less liable to damage. Condition of soil, with possible deficiencies, may account for differences in behavior of individuals.

***Abelia grandiflora* hybrid, M316**

Growing in sheltered position. Entire vegetative growth killed to ground. Recovery from root-stock good.

***Albizia julibrissin*, Durazz, M783**

A healthy specimen of this semi-hardy tree growing in a low, wet position, was completely killed to ground, but from the root-stock healthy growths, 9 to 10 feet high, were developed during the following summer.

With the exception of the following list of deciduous and evergreen species of Barberry, these ornamental shrubs withstood the low temperatures fairly well.

DECIDUOUS

***Berberis aggregata*, Schneid., M101**

Entire growth killed to ground. Recovery fair.

***Berberis aggregata* var. *Prattii*, Schneid., M2264**

Ninety per cent of growth killed. Recovery fair.

***Berberis Vernae* hybrid, M108**

Entire plant killed to ground. Recovery poor.

***Berberis Wilsonae*, Hemsl. & Wils., M2627**

Entire growth killed to ground. Recovery good.

EVERGREEN

***Berberis Gagnepainii*, Schneid., M2322**

Forty per cent of growth killed by spring. Recovery poor.

***Berberis triacanthophora*, Fedde., M2326**

Twenty-five per cent of growth killed by spring. Recovery poor.

***Berberis Sargentianus*, Schneid., M2323**

Eighty per cent of growth killed by spring. No recovery.

***Berberis Veitchii*, Schneid., M2324**

Fifty per cent of growth killed by spring. No recovery.

***Calycanthus occidentalis*, Hook & Arn., M1224**

Growing on protected hillside with S. E. exposure. Entire growth killed to ground, but recovery from base very good.

***Cedrela sinensis*, Juss., M764**

Large tree growing in low, moist ground; received 10% branch killing, but many suckers surrounding parent plant were uninjured.

***Clerodendron trichotomum*, Thunb., M74**

Growing on low, moist ground. Entire plant killed. The same species growing on steep hillside was killed to ground, but produced strong growth during the following summer.

***Davidia involucrata*, Baill., M520**

The Dove Tree. Large specimen growing in low, moist position. Entire tree killed to ground, partly by a disease infecting the trunk, which destroyed the resistance to sub-zero temperatures. During the following summer, strong, healthy growths were produced from the base, some attaining a height of from six to seven feet.

The following list of species of the May flowering deciduous shrubs, known as Deutzias, all exhibit the same susceptibility to extremely low temperatures. These species were completely killed to the ground, but from the root stock of some of them an abundance of strong, healthy growths gave rise to a new and improved specimen, while other species that were older specimens did not respond so readily to new life.

***Deutzia carnea stellata*, Rehd., M2299**

Did not recover.

***Deutzia discolor*, Hemsl., M801**

Recovery from base good.

***Deutzia longifolia*, Frane, M1802**

Recovery poor.

***Deutzia parviflora*, Bge., M1800**

Fifty per cent of top killed. Recovery good.

***Deutzia Vilmorinae*, Lemoine, M161**

Killed to ground. Recovery good.

Deutzia crenata. D. scabra and varieties

Recovery good.

Deutzia gracilis, Sieb. & Zucc., and *Deutzia rosea*, Rehd., proved to be the hardiest species of the Deutzias. These did not receive the slightest injury to growth or flower buds.

The Diervillas, particularly *Diervilla florida* (Sieb. & Zucc.) varieties, received severe injuries resulting in the destruction of old wood only, indicating low temperatures were not the only cause. Young, vigorous growing branches were resistant to the abnormal climatic conditions. The specimens were grown in both sheltered and exposed positions.

Elaeagnus pungens maculata, Rehd., M328

Growing on protected hillside, S. E. exposure. Ten per cent of branches killed.

Elaeagnus multiflora, Thunb., M1336

Eighty per cent of growth killed. Recovery from base excellent.

Erica vagans, L. (Cornish Heather), M333-334-335

Three large, well-established specimens, growing in well-protected area with southern exposure, were totally destroyed. Young, one-year-old rooted cuttings in slightly protected frame were uninjured.

Fontanesia Fortunei, Carr., M861

Large and old specimen, sheltered from N. and N. W., killed to ground. Recovery at base very poor.

Forsythia suspensa, Vahl., *Forsythia suspensa Fortunei*, Rehd., *Forsythia viridissima*, Lindl., *Forsythia intermedia*, Zabel., received severe injuries to flower buds exposed above the snow surface, also tip burn to branches. The mature wood proved to be quite hardy.

Hovenia dulcis, Thunb. (Japanese Raisin Tree), M459

Large, healthy specimen growing on high, well-drained soil in semi-sheltered position. Entire top of tree killed to within 12 feet of the ground. Many healthy branches were produced from the pruned limbs during the following growing season.

Idesia polycarpa, Maxim., M953

Large specimen badly infected by disease and in unhealthy condition was completely killed. Young seedling plants 1 to 2 feet high, growing on high, exposed ground, 50% killed. Recovery good.

Ilex crenata, var., M2363

Killed to within one foot of the ground. Recovery fair.

***Ilex crenata*, var., M2364**

Killed to within one foot of the ground. Recovery good.

***Ilex crenata*, Thunb., M217**

Ninety per cent of growth killed. Recovery fair.

***Ilex crenata*, var., M218**

Killed to within one foot of the ground. Recovery good.

***Ilex aquifolium*, L. (English Holly), M129-M329**

Strong, healthy specimens 15 feet high, growing on a protected hillside sloping to S. E., and surrounded by other trees and shrubs. Entire growth killed to ground and a few weak growths developed from base.

***Ilex Pernyi*, Franch., M309**

Growing in same position near the above. Entire top killed to ground. Recovery very poor.

***Ligustrum acuminatum*, Koehne, M228**

Large single specimen 10% injured. Recovery good.

***Ligustrum amurense*, Carr., M2243**

Single specimen plant, 15 feet high. Entire top killed to ground. Many healthy growths, 5 feet to 6 feet high, produced during the following summer.

***Ligustrum ovalifolium*, Hassk., M3006**

Large single specimen, 20 feet high, 30% of growth killed. Recovery from base very good.

***Ligustrum ovalifolium*, Hassk.**

Californian Privet Hedge growing on steep hillside sloping to N. W., 90% of growth killed. Recovery from base has been good.

***Magnolia grandiflora*, L., M513**

Tree 10 feet high, growing on low, moist ground and protected by a covering of corn fodder. The main trunk represented 80% of the tree, which was killed to the ground. Small side growths at the base were uninjured. No appreciable recovery.

***Magnolia grandiflora*, L., M600**

Specimen tree 18 feet high, growing on a steep, dry bank and protected from N. and N. W. by a building, and from the south by woods. Received no winter protection of corn fodder. This evergreen species showed only abnormal browning and shedding of leaves. Recovery was rapid and permanent.

***Mahonia japonica*, D. C., M1212**

Entire plant killed to ground.

***Nandina domestica*, Thunb.**

Five specimens of this shrub, which is of doubtful hardiness, growing on a sheltered hillside and provided with corn fodder protection, received an average of 50% growth killed. The following summer's growth made up the 50% loss.

***Poncirus trifoliata*, Raf.**

A number of large specimen plants of the Hardy Orange, growing on a sheltered hillside, received 90% killing of all branches. After pruning, a few branches were produced from 1" caliber stems, but owing to frost cracks, internal injuries, and disease infection, these plants were destroyed. Two-inch caliber stems did not develop new growth.

***Prunus subhirtella pendula*, Tanaka, M1071**

Large grafted tree growing on exposed windswept hill—lost 5% and 75% of flower buds. Another plant of the same species growing nearby had 90% damage to flower buds, but no growth injury. Still another specimen of the above, growing in a protected and lower elevation, received 20% flower bud damage only.

***Pyracantha coccinea Lalandii*, Dipp., M559**

Large and old specimen of the Firethorn, growing on slightly elevated ground, was killed entirely. A younger specimen of the above species, growing nearby, received a branch tip burn only, with no permanent injury resulting.

Rhododendron

Large-leaf, hardy hybrids growing in low, moist ground, exhibited only normal winter injury.

Rhododendron obtusum Kurume hybrids, growing in the same position as the above, were permanently destroyed.

***Rhododendron obtusum amoenum*, Rehd.**

Received 70% growth injury.

Rhododendron obtusum*, var. *Hinodegiri

Also in the low position. Was 80% killed, while the same variety, growing at a higher elevation and in a windswept location, suffered 10% loss of vegetative growth.

It is also interesting to note that *Rhododendron yedoense*, Maxim., and the variety *poukhanense*, Nakai, growing in this low, moist position, did not exhibit any injurious effects from the abnormal, sub-zero temperatures.

***Stapylea pinnata*, L., M158**

Entire plant killed to ground. A few weak growths developed during the following summer. Another specimen of the same species, with same degree of injury, produced growths 6 to 7 feet long from the base.

***Styrax obassia*, Sieb. & Zucc., M476**

A large specimen growing in sheltered position—had 80% of growth killed. Recovery fair from trunk only.

***Styrax japonica*, Sieb. & Zucc., M2097**

Killed to ground by disease and extreme cold; weak growths from base, but no permanent recovery.

***Viburnum betulifolium*, Batel, M16**

Growing on exposed slight elevation. Entire growth killed to ground. Recovery from base fair.

***Viburnum hupehense*, Rehd., M5**

Same position and injury. Recovery from base good.

***Viburnum opulus nana*, M526**

Dwarf compact plant—90% of growth killed. Recovery good.

***Viburnum scabrellum*, Chapm.**

One large and one small specimen. Both were injured 20%, and recovery was good.

***Viburnum tomentosum sterile*, K. Koch.**

Killed to ground, but during the following summer new growths 3 feet high developed.

***Viburnum rhytidophyllum*, Hemsl., M448**

Large, healthy specimen, 15 feet high, 15 feet spread, growing on protected hillside having S. and S. E. exposure. A 50% killing of the branches resulted in weak growths from the upper growth the following summer, but from the base new growths developed to a height of 6 feet. This specimen would have recovered had there been a more favorable season the following year.

JAMES LAMBERT.

DEATH OF COLONEL ROBERT GLENDINNING

COLONEL ROBERT GLENDINNING, a member of the Advisory Board of Managers, died on April 19, 1936, at the age of sixty-nine years.

His life was marked by a successful business career, to which was added one of distinguished public service. He served in the cavalry through the Spanish-American War. He founded the Aviation School at Essington in 1917, and served as Lieutenant-Colonel in the United States Air Service of the American Expeditionary Force in the Great War. For many years he was a member of the Fairmount Park Commission.

GARDEN NEWS

WITH THE COMING of spring, the Arboretum became increasingly a place of interest. Fourteen groups from ten educational institutions came as classes to study the plant life to be seen here.

Garden clubs and other outing groups in similar numbers have enjoyed the various flowering groups as the season has passed.

Again the Arboretum has been the meeting place of larger groups. On May 9th, the May Frolic of the women students of the University of Pennsylvania and the Alumnae Luncheon brought in about two thousand people.

The spring meeting of the Society of the Sigma Xi, the honorary scientific society of the University of Pennsylvania, was held at the Arboretum. A short program, descriptive of the activities of the place, and a buffet supper, brought an attendance of about three hundred persons.

The Liberal Arts Board of the University of Pennsylvania met here on May 25th.

The Faculty Tea Club of the University of Pennsylvania met at the Arboretum on May 26th, approximately six hundred members and guests being present.

The women of the Senior Class of the University of Pennsylvania held Class Day exercises and a garden party at the Arboretum on June 9th.

The Arboretum has been open to the public from one to five o'clock on Wednesdays, Thursdays and Saturdays, with a large number of visitors.

May 30th and 31st, Saturday and Sunday, were Spring Open Days the grounds being open from nine to five o'clock, with large numbers being present.

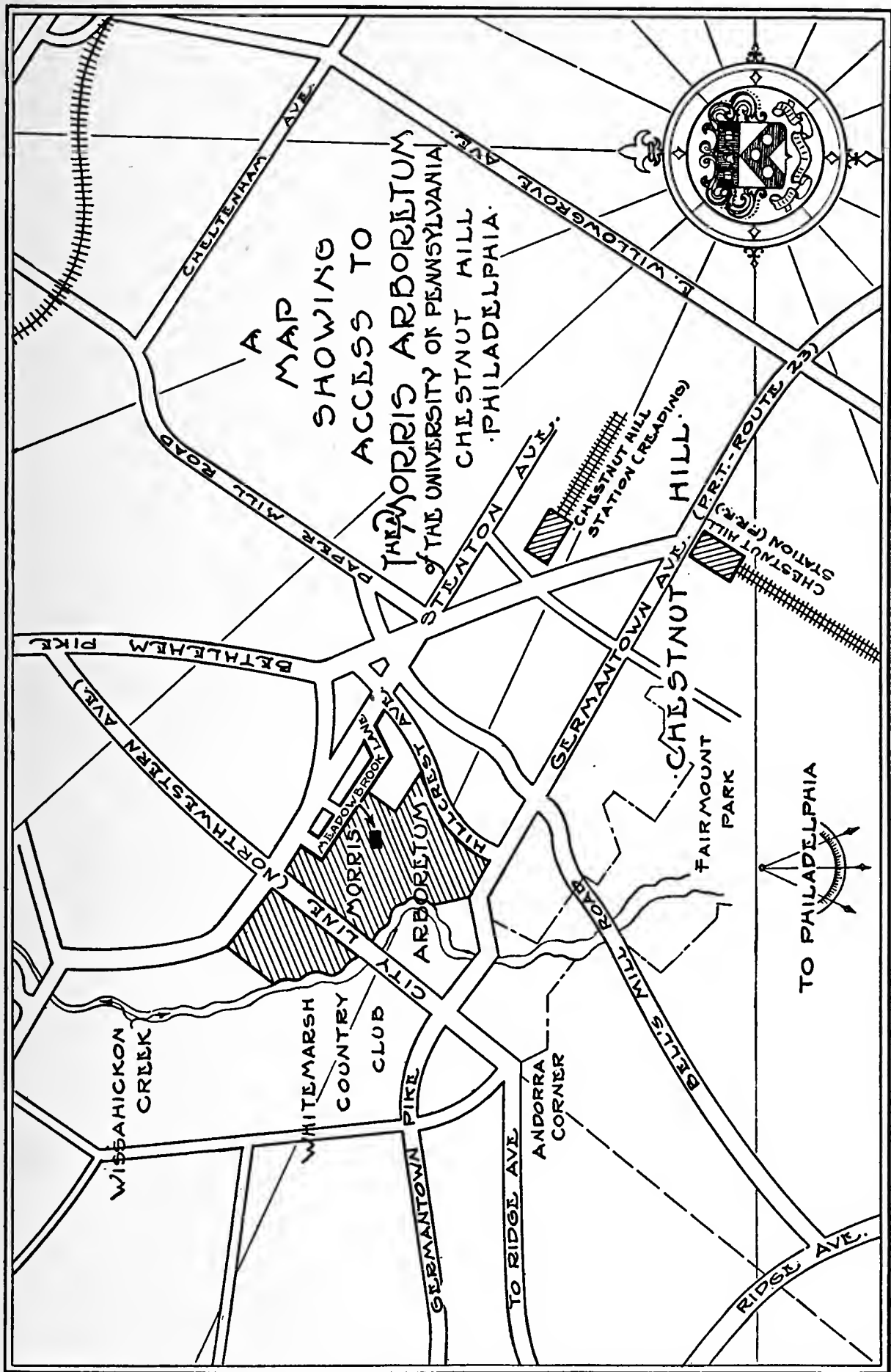


ACKNOWLEDGMENTS

THE ARBORETUM acknowledges with thanks the addition to its library of thirty-one volumes of the Contributions from the National Herbarium, presented by the National Museum.

Henry A. Dreer, Inc., of Philadelphia, has favored the Arboretum, and added to the interest of the rose garden by the gift of fifty plants each of "Carrie Jacobs Bond" and of "Little Beauty" Roses.

The New York Botanical Garden has added valuable material to the Herbarium of the Arboretum by presenting to it 716 sheets of woody species collected by Dr. Camillo Schneider in the Arnold Arboretum in 1915 and 1918.





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MORRIS ARBORETUM
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THE MORRIS FOUNDATION
Maintaining THE MORRIS ARBORETUM
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THE
MORRIS ARBORETUM
OF THE
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One-Leaved Pine
Pinus cembroides Zucc. variety *monophylla* Voss

The tree shown in the illustration is known to botanists as *Pinus cembroides* Zucc. variety *monophylla* Voss. It is a variety of the Nut Pine that occurs in Arizona, California, and in Colorado. It reaches a height of 40 to 50 feet, and is remarkable in bearing but one leaf in each sheath, and is therefore sometimes known as the "one-leaved" pine. The leaves are 1 to 2 inches long, rigid, glaucous-green in color. The cone is broad-ovoid, 1½ to 2 inches long, with a minute incurved prickle at the end of each scale.

The tree here shown was about 20 feet tall. Although it is now dead, successful cuttings from it have been made, and it will continue to be represented in the Arboretum.

The photograph was taken by Professor H. H. York.

RODNEY H. TRUE

INJURY CAUSED BY ILLUMINATING GAS*

—BY—

DR. WILLIAM CROCKER

Director of the Boyce Thompson Institute for Plant Research

THE AUTHOR spoke of three groups of substances in illuminating gas that must be considered when one is dealing with the injurious and other effects of illuminating gas upon plants:

1. Substances readily soluble in soil water; cyanogens, especially hydrocyanic acid.
2. Substances not readily soluble in soil water, but rather readily condensed in oil; drip oils, especially members of the benzene and benzine series.
3. Gases of low solubility in soil water and not readily condensed in soils—methane, acetylene, ethylene, carbon monoxide, and other gases.

Illuminating gas escaping into a greenhouse or room injures plants through the presence of ethylene, and largely through the stimulating and anaesthetic action of the ethylene. The top of the plant is generally much more sensitive to ethylene than the root system, also ethylene is only slightly soluble in water and in plant tissues, so it does not accumulate and soon diffuses out of the plant tissue when the concentration outside is not maintained. For this reason it must be held around the plant continuously for some time to produce the physiological reactions. Hence, injuries to plants by ethylene occur mainly in enclosed places that hold the ethylene around the plant, and do not occur in the open where the gas is carried away readily by moving air currents.

Injury to trees by illuminating gas escaping into the soil in close proximity is largely due to the chemical substances that dissolve in the soil water or accumulate in the soil by condensation. Hydrocyanic acid is likely to be the main source of

* Abstract of part of a lecture given April 11, 1936, at the Morris Arboretum of the University of Pennsylvania.

injury to trees from leaks in gas mains. This is especially true with rapid temporary passage of gas through the soil. Even gas that is washed free from hydrocyanic acid leaves toxic material in the soil if a sufficient amount (20 to 24 times as much) is passed through the soil.

This is due to the second most toxic group of gases in the illuminating gas that accumulates in the soil, namely, the drip oils. The less volatile portion of the drip oils condenses in the gas pipes and remains there, or if some of it escapes it is limited to the soil in the immediate region of the leak. The less volatile portion of the drip oils is likely to be condensed in the soil near, as well as at some distance from, the leak. Both of the groups of substances mentioned above do injury by killing the roots and the lower parts of the stem. With a sufficient amount of the third group of substances in illuminating gas flowing through the soil for a long period, considerable injury may be caused. The injury results in intumescences or swellings on roots, distortion of root tips, yellowing of leaves, and leaf fall.

Since hydrocyanic acid is the highly toxic substance to trees from illuminating gas escaping into the soil, the power to reduce the injury to trees by gas is largely in the hands of the gas manufacturers. They can reduce tree injury from this source by so adjusting their processes that they will remove all the hydrocyanic acid. This will not, however, remove the necessity of great care in laying, maintaining, and frequently inspecting their pipe lines for leaks, for sufficiently large leaks can do injury due to the second group, or the drip oils, and even due to the third group, or the true gases. In fact, in very slow leaks, where the hydrocyanic acid accumulated slowly, it was found that some ethylene effects, such as downward bending and yellowing of foliage, showed up before the killing effects of hydrocyanic acid appeared.

After a leak has occurred that has killed trees, what is the proper treatment of the soil preliminary to replanting trees in the gassed soil? Hitchcock, Crocker and Zimmerman found three different factors that free the soil of the toxic residues from illuminating gas, (1) volatilization into the air, (2) transformation of the residues in the soil due to the action of the organisms, and (3) leaching residues out of the soil by water. Loss of toxicity from gassed soil was found to be rapid when the soil was stored in the open at temperatures from 20° to 80° C. Two to five days of exposure of small amounts of the soil under this condition eliminated most of the

toxic materials. If one wants to rid the soil rapidly of the toxic materials, it will be best to expose it frequently to the air by repeated shoveling or by leaching with a large volume of water.

The first two groups of substances mentioned above kill tissues, but otherwise have little effect that is of physiological interest. Certain compounds of the third group, namely, ethylene, acetylene, propylene and carbon monoxide, cause little if any necrosis, but show marked anaesthetic and stimulative effects. Offhand, one might expect an anaesthetic which tends to stop growth to lack the power to stimulate growth and even initiate growth in dormant cells. This, however, is not the case when proper concentrations of any one of the four gases mentioned above are applied to plants. This is well illustrated by the fact that while the proper concentration of any of these gases in the air will cause the growing parts of the stems of the tomato, sunflower, and other plants, to stop growing, at the same time it will induce growth on the upper side of the petioles, causing even those leaves that have ceased to grow to turn downward.

The four gases just named seem to have identical effects upon plants, but the minimum concentration in the air required to produce a given effect varies greatly with the four gases. The accompanying table shows the comparative effectiveness of the four gases in inducing responses in the sweet pea seedling and in the tomato plant:

GAS	Minimum parts per million needed to produce:	
	Declination in sweet pea seedlings, according to Knight and Crocker*	Epinasty in tomato petiole**
Ethylene	0.2	0.1
Acetylene	250.0	50.0
Propylene	1000.0	50.0
Carbon monoxide	5000.0	500.0

* 3 days' exposure used; ** 2 days' exposure used.

In inducing the downward-turning (epinasty) in tomato leaves, ethylene is 500 times as effective as acetylene and propylene, and 5000 times as effective as carbon monoxide. This table gives approximately the relative effectiveness of the several gases in producing all the plant responses mentioned.

The bending downward of the leaf of the tomato plant is very useful in detecting traces of illuminating gas in greenhouses and dwellings, traces of exhaust gas in garages, or traces of mine gas in mines. One part of illuminating gas to 400,000 parts of air at 20° C. will give about 45° bending response in leaves of the tomato in 48 hours. One part of ethylene to 10,000,000 parts of air will give a similar response. (Fig 1)

When a plant is exposed to various concentrations of any one of these gases, the amount of reduction in growth increases with the concentration of the gas until a concentration is reached in which it is completely stopped. This is the general effect of these gases on all plants and is a typical anaesthetic effect. The tip of sunflower and tomato stems is without motion during the exposure to 1 part of ethylene to 500,000 parts of air, and they recover this motion soon after removal from the ethylene.



Fig. 1

Response of Tomato Plants to different concentrations of illuminating gas in the greenhouse. Note the downward bending of the leaves (epinasty), increasing as the concentration of gas increases.

BIRDS OF THE ARBORETUM

THIS SPRING the migration, due to the exceptionally fine weather, was steady and continuous, and therefore made it difficult for the observer to obtain a representative list unless he could be in the Field each day. Particularly was this true in respect to the Warblers, as there were no storms to hold them back for several days and bring about the well known flight "waves." The clear, bright nights enabled the small birds to seek their way when and as they wished, and no doubt many species were not to be found in the Arboretum which otherwise would have been.

Of great interest was the large number of Cowbirds which were found in groups of their own and also mixed in with flocks of robins and starlings. None were seen associated with Red-wings. Never before has the writer had the privilege of observing so many together in such a limited area. Ospreys flying over this district are not rare but it is unusual for one to fish in such a small creek. An amusing incident was caused by a starling fighting a gray squirrel away from its nesting hole. The bird won the struggle by darting at the squirrel each time it moved, and finally pecked it so hard on the rump the animal lost its grip of the bark and fell into a shrub about ten feet below.

Cutting the meadow grass has killed many Meadowlarks, Red-wings and Bobolinks and made impossible the nesting of numerous others. If this could be delayed several weeks in future years a great number of birds would be saved. It was at first a surprise to find so few birds in the woods, but upon consideration this is undoubtedly due to the lack of undergrowth. The scarcity of Oven-birds is owing to the same fact.

The following species were added to the list during the period from the tenth of March to the tenth of June, 1936:

American Bittern—*Botaurus lentiginosus*

An individual of this species remained in the small marsh bordering the back-water of the creek during the last week of April.

Turkey Vulture—*Cathartes aura septentrionalis*

One seen soaring high over the farm.

Osprey—*Pandion haliaetus carolinensis*

One was observed searching for fish in the creek where it flows by a corner of the farm. The bird passed from sight following the creek's course upstream.

Spotted Sandpiper—*Actitis macularia*

Only one was seen which is surprising. It was teetering along the bank of the creek by the woods.

Yellow-billed Cuckoo—*Coccyzus americanus americanus*

Three were found. Two in the woods and the other in the thick growth on the edge of the greenhouse garden.

Chimney Swift—*Chaetura pelagica*

This species was seen in groups of three or five flying over both Compton and Bloomfield.

Ruby-throated Hummingbird—*Archilochus colubris*

One was observed feeding on the fragrant flowers of the trees and shrubs along the upper brook.

Northern Crested Flycatcher—*Myiarchus crinitus boreus*

Individuals of this species were seen in both Compton and Bloomfield, wherever there are fair-sized groups of trees.

Eastern Phoebe—*Sayornis phoebe*

This familiar bird was found by the duck pond; on the upper brook by the cabin; along the creek in several locations, and by the mill race near the bridge and at the mill.

Barn Swallow—*Hirundo erythrogaster*

Seen in numbers sweeping over the meadows and perched on telephone wires.

Eastern House Wren—*Troglodytes aedon aedon*

Found in numbers everywhere but the meadows.

Catbird—*Dumetella carolinensis*

Seen in every thicket and group of closely planted trees.

Brown Thrasher—*Toxostoma rufum*

Only one observed and that was in a thicket on the border of the upper Japanese garden.

Wood Thrush—*Hylocichla mustelina*

Seen in each well-shaded nook and lane and the woods

Veery—*Hylocichla fuscescens fuscescens*

Two found; one in the Japanese garden by Hillcrest Avenue, and the other in the woods.

Red-eyed Vireo—*Vireo olivaceus*

Seen in numbers over whole area except the meadows.

Black and White Warbler—*Mniotilta varia*

Two seen in the woods.

Blue-winged Warbler—*Vermivora pinus*

One found in shrubs where upper brook joins the creek.

Nashville Warbler—*Vermivora ruficapilla ruficapilla*

One seen in trees by stone summer house.

Eastern Yellow Warbler—*Dendroica aestiva aestiva*

Three were observed; two in shrubs by the duck pond and the other in the orchard.

Myrtle Warbler—*Dendroica coronata*

Found in flocks and singly wherever there are trees and shrubs.

Blackburnian Warbler—*Dendroica fusca*

Two seen in trees by the garage.

Chestnut-sided Warbler—*Dendroica pensylvanica*

Six seen in trees by the garage.

Bay-breasted Warbler—*Dendroica castanea*

One observed in trees by the garage.

Black-poll Warbler—*Dendroica striata*

Almost as numerous as the Myrtle Warblers and well scattered throughout the area.

Yellow Palm Warbler—*Dendroica palmarum hypochrysea*

Three seen in shrubs by duck pond.

Oven-bird—*Seiurus aurocapillus*

Only one seen, which is remarkable, and that was in the woods by the cabin.

Northern Water-thrush—*Seiurus noveboracensis noveboracensis*

One seen in upper brook near duck pond.

Maryland Yellow-throat—*Geothlypis trichas trichas*

Several found by duck pond; along upper brook near the cabin and on the banks of the creek.

American Redstart—*Setophaga ruticilla*

Two seen in trees by the garage.

Bobolink—*Dolichonyx oryzivorus*

A large flock was found on the rolling meadows of the farm.

Eastern Red-wing—*Agelaius phoeniceus phoeniceus*

Observed in numbers on the meadows of both Compton and Bloomfield.

Baltimore Oriole—*Icterus galbula*

Two seen; one in the orchard and the other in the glade by the boathouse.

Eastern Cowbird—*Molothrus ater ater*

A surprisingly large number of this species was found. They were equally divided between the lawn adjoining the avenue of oaks and the lawn between the upper brook and the greenhouse garden.

Scarlet Tanager—*Piranga erythromelas*

One seen in the trees between the main building and garage.

Rose-breasted Grosbeak—*Hedymeles ludovicianus*

One found in the woods.

Indigo Bunting —*Passerina cyanea*

Three were seen; one in the trees by the stone summer-house, another on the edge of the woods and the third near the mill.

Red-eyed Towhee—*Pipilo erythrophthalmus erythrophthalmus*

Several were observed in and adjoining the avenue of oaks.

Eastern Savannah Sparrow—*Passerculus sandwichensis savanna*

One was seen on the farm in high meadow grass on the edge of planted strip.

Eastern Tree Sparrow—*Spizella arborea arborea*

One was found in an evergreen between the avenue of oaks and the upper brook.

Eastern Chipping Sparrow—*Spizella passerina passerina*

Numerous over the whole area except the meadows.

Swamp Sparrow—*Melospiza georgiana*

One seen by upper brook near cabin.

LEWIS MACCUEN SMITH.

DEATH OF MR. WILLIAM WARNER HARPER

MR. WILLIAM WARNER HARPER, a member of the Advisory Board of Managers of the Arboretum, succumbed to an attack of heart disease on December 18, 1935, in his sixty-eighth year, after suffering nearly two years from this malady.

Mr. Harper was born in Germantown. He held a position for a time with the Midvale Steel Company, and later entered the employ of Miller and Yates, nurserymen of Mount Airy. In 1891, he became connected with the Andorra Nurseries, then owned by Henry H. Houston, of Chestnut Hill. Four years later, he purchased the business that expanded rapidly under his management. He became, also, the head of other enterprises of a similar character at Towson, Maryland, at Columbus, Ohio, and at Paris, Kentucky.

He took an active part in the affairs of Montgomery County, serving as County Commissioner in 1914, later becoming president of the Board.

He was a member of the Pennsylvania Horticultural Society, and of other botanical organizations, also a trustee of the Tyler Arboretum at Media.

He took an active part in the civic and business life of the community, and served as a director of the National Bank of Germantown and of the Germantown Trust Company.



CORRECTION

READERS OF THE sketch of the life and ways of the tent caterpillar, that appeared in the July number of the BULLETIN (No. 4), should know that the sketch was from the able pen of Professor Philip P. Calvert, of the Department of Zoology of the University of Pennsylvania. It is hoped that Professor Calvert may favor the BULLETIN from time to time with more of these sketches of the life histories of our insect friends or enemies.

PLANT COLLECTING TRIP

IT HAS become a habit for members of the staffs of the Arboretum and of the Department of Botany of the University of Pennsylvania to devote the week following the close of the spring term at the University to the exploration of some part of the state of Pennsylvania not well known botanically, for the purpose of studying the flora in the field. Collections are made by members of the types of plants in which they are particularly interested, and the dried specimens are placed in the herbaria of the University and of the Arboretum. In general, specimens of trees and shrubs come to the Arboretum.

Eleven persons made the party that spent the last week in June in Pike and Wayne Counties. Travel was by the Arboretum bus. Somewhat over a thousand specimens were added to the collections, including several rarities. Geographical distribution with reference to latitude, to soil characteristics and to the glacial history, offered problems of study.



WINTER LECTURE COURSE

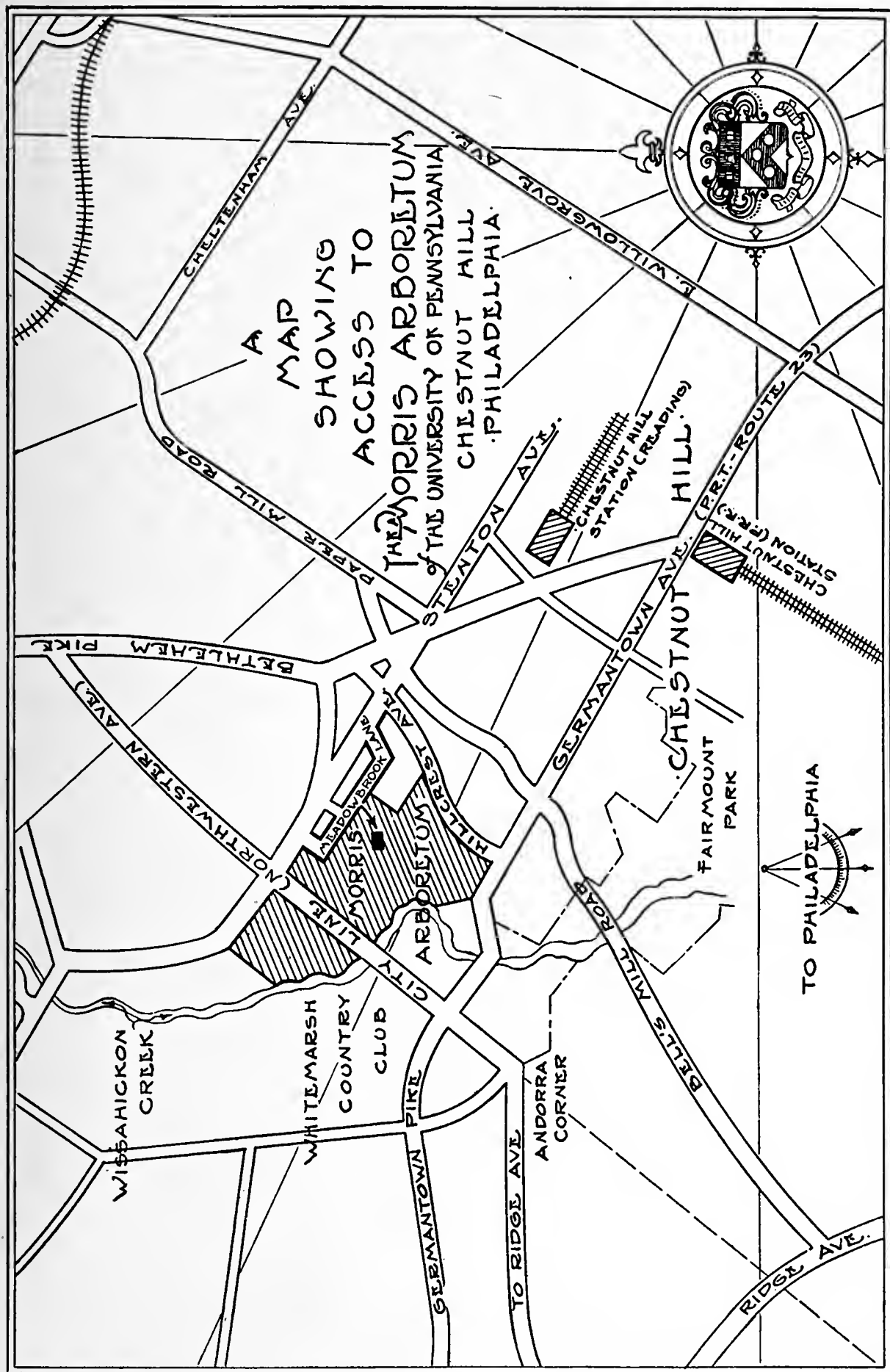
THE GENERAL SUBJECT of the winter lectures to be given at the Morris Arboretum during the coming winter months will be "*Flowering Trees and Shrubs.*"

The first lecture will be given on December 12th, by MR. JOHN C. WISTER, on the subject of Lilacs.

Lectures will be given at 2.30 P. M. on the second Saturday of the month, at the Arboretum. Entrance by the Meadowbrook Lane gate. Further announcements will follow.

Foliage Days at the Arboretum

The Arboretum will be open to visitors from 9 A. M. until 5 P. M. on Saturday, October 17th and on Sunday, October 18th. It is hoped that the autumn colors may be at their best at that time. No admission cards will be required.





ARBORETUM BULLETIN
OF THE
ASSOCIATES

JANUARY, 1937

THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

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Maintaining THE MORRIS ARBORETUM
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RODNEY H. TRUE, *Director*

* Deceased

THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA



White Pine
Pinus Strobus L.

The tree shown in the frontispiece illustration is the familiar White Pine of our Northern States, *Pinus Strobus*, L. This has been a chief source of valuable lumber since the white man came to America, and has suffered greatly at his hands. It is distributed from Newfoundland to Manitoba, southward through the Northern States to Pennsylvania, northern and eastern Ohio, central Indiana, and as far west as central Iowa. It follows the Appalachian Mountains to Eastern Kentucky, Tennessee to northern Georgia (Sargent). It is much planted for its ornamental value and for its unquestioned hardiness. It is also one of the species mainly used in reforestation in the northern states.

This pine has five leaves in a fascicle, 3 to 5 inches long. The cone is from 4 to 8 inches long. The trunk is usually straight, and rises to a height of 100 feet when mature. It has been known to reach 220 feet, with a stem diameter of 3 to 4 and even 6 feet. The young specimen seen in the picture is about 30 years old. It was photographed by Professor H. H. York.

RODNEY H. TRUE

LILACS*

—BY—

JOHN C. WISTER

Director, Arthur Hoyt Scott Horticultural Foundation, Swarthmore College

THE GENUS *Syringa*, which is the botanical name for the Lilac, belongs to the great Olive family, which includes also Privets, Forsythias, and other well-known garden shrubs. Our common Lilac (*Syringa vulgaris*, L.) comes from Hungary and Rumania, and is one of the two European species, the other being *Syringa Josikaea*, Jacq. Practically all of the other species are from the far east with China as the headquarters. Of these eastern species, *Syringa villosa*, Vahl., was introduced from north China in 1885, *Syringa pubescens*, Turcz. in 1880, and *Syringa oblata*, Lindl. in 1856. Nearly all of the others have been discovered and introduced in the present century, most of them between 1905 and 1915. They are of great interest to botanists, but the two most important species to gardeners are *Syringa persica*, L. and *Syringa vulgaris*, L.

Syringa persica, L. was cultivated in Persia before the year 1200 and was well known in England in 1600, and in this country in 1800, but its real home is Kansu, China, where it was discovered growing wild by Meyer in 1915. This is a splendid garden shrub deserving a place in even the smallest collection.

The common Lilac has been in cultivation in northern Europe since the 16th century, having been brought there from Turkey. It was much confused by writers, however, with the Mock Orange, and even in the present day people can be found who refer to Mock Orange as *Syringa*.

Gerarde, in 1857, wrote: "These trees grow not wild in England, but I have them growing in my garden in very great plenty." He called it the "blew pipe tree" and noted that "older phisitions do name it lillach or lilach."

Miss Keeler has stated that it was in America as early as 1652, and Dr. Harshberger has quoted Bartram, complaining in 1753 of the shipment of lilacs to him,

* Summary of a lecture given at the Morris Arboretum of the University of Pennsylvania on December 12, 1936.

because there were plants already too numerous in his garden. Mrs. McKelvey, who made the greatest study of the Lilac, states that there is no authentic record of their being in this country before 1767, in which year there is noted in Thomas Jefferson's diary, on April 2nd, that he planted Lilacs. She quotes, also, George Washington's diary of March 3, 1785.

It is curious that all the plants mentioned in these early records were of garden origin, and that no one knew the real wild home of this plant until it was found in 1828 in Rumania, and in 1841 in Bulgaria.

The cultivation of Lilacs is simple. While they will grow in any soil, they do not do well unless given ample food, either in the form of manure or commercial fertilizers. Fall planting is better than spring planting because the leaves start so very early. Much pruning is not necessary. The removal of crossing or straggly branches is usually enough at first, and as the plant gets older, an occasional old branch should be removed to give the young growth, which will bloom more freely, opportunity.

Propagation of the Lilac is by seeds, cuttings, grafting and budding. Named varieties of course will not come true to seed, and the common commercial practice is to graft them, because that is quicker than growing them from cuttings. Many gardeners have objected to the practice of grafting Lilacs on privet, and learned papers have been written to prove that this always results in the disease which has been named graft blight. Many practical gardeners, however, have succeeded admirably with these plants so propagated without undue difficulty. If the grafting is done with a long scion, and the plant the first year is placed very deep so that the top bud of the scion is at the level of the ground, own roots will form in the first year or two, and the privet stock may then be removed. This is the practice of many growers.

Plants propagated by budding are not as satisfactory, because the plants cannot be planted deeply until the lilac is a year or more old and the wood is harder. Propagation by cuttings is theoretically the best, but it takes some skill and practice to take the wood at just the right stage which, in the climate of Philadelphia, is usually about the first of July. Some growers are now resorting to root cuttings in winter and report excellent success.

Literally hundreds of named varieties are in commerce, and it is not necessary for the ordinary garden to have more than a dozen or twenty-five of these to get a representative collection. A few of the named varieties like *Lovaniensis* and *Macrostachia* are a century or more old, and there are in commerce named varieties of Dutch, Belgian and French origin, which are at least half a century old.

In general, however, most of these have been greatly surpassed by the modern kinds introduced in the last twenty-five or thirty years, nine-tenths of which are from the great firm of Lemoine, in Nancy, France. If we except the varieties Mme. F. Morel, Souvenir Ludwig Spaeth, Mrs. W. E. Marshall and President Lincoln, practically all the other varieties that I shall name are from Lemoine.

It is not possible here to give an extensive list, but I should like to urge gardeners to try the single white varieties—Vestale, Mont Blanc and Marie Finon—and the double whites—Miss Wilmott and Edith Cavell. In bluish and violet shades there are Cavour, de Miribel, Decaisne, President Lincoln, Boule Azuree and Maurice Barres in singles, and in doubles, Emil Gentil, Marechal Lannes, Olivier de Serres, President Viger, Rene Jarry Desloges, Thunberg, Henri Martin and Victor Lemoine.

On the pinkish and reddish tones in singles are *Macrostachia*, Lucy Baltet, Congo, Marengo, Massena and Mme. F. Morel, and in doubles, Belle de Nancy, Mme. Buchner, President Fallieres and Georges Bellair. In the deepest purple shades are Ludwig Spaeth, Monge, Rochambeau, Vulcan and Vesuve.

Any of these varieties will be found satisfactory under conditions of reasonably good drainage and open sunlight. They will not bloom well in deep shade, although the plants may survive for some time. As they all bloom in the season of the Tulips, Intermediate Irises and *Scilla nutans* and *campanulata*, many combinations of color can be made with these flowers.

I have touched on but a few of the older established varieties. Many novelties are being introduced which may be finer, and I hope that gardeners will watch for some of the newest things from Lemoine and from some of the new seedlings of the late T. A. Havemeyer, of Long Island, of Mrs. Klager, of Oregon, and Miss Preston, of Ottawa, Canada.

SUMMER INJURY TO CONIFERS AND OTHER WOODY ORNAMENTALS

JAMES LAMBERT, *Superintendent*

DURING THE PAST growing season the vegetation at the Morris Arboretum has been subjected to severe climatic changes that have caused varying degrees of injury, some of which were far above the average for this vicinity. Late frost and strong winds during the spring wrought havoc with the young, tender leaves of some deciduous trees. This was followed by a prolonged period of drought and, early in July, unusually high temperatures for this region were recorded. Then, again in the fall, a greater drought was experienced than earlier in the season.

There was a temporary browning of the grass, but no injurious effects were observed to trees and shrubs that could be traced to drought. However, both temporary and permanent injuries were sustained by plants that could be definitely traced to the abnormal heat wave of July 9th and 10th, when an official temperature of 103° F. and 104° F., respectively, were recorded by the U. S. Weather Bureau for Philadelphia. Following these high temperatures, signs of injury to young conifers growing in a fully exposed nursery were noticeable, which two days later resulted in a general browning of vegetative growth. This damage was represented by wide areas of dead foliage and branches on the south side only of the plants, or, as exhibited in two large, flat spreading Junipers, the tender tips of the highest branches were scorched as if by an open flame. By sighting these dead areas with the position of the sun, it was possible to judge that the injury occurred between 11 A. M. and 1 P. M., since other parts or sides of the plants were unaffected.

The following list of conifers, with the approximate percentage of injury, together with other species of the same genus which were uninjured, may serve as a comparative basis of susceptibility to high temperatures by direct sun rays, since all species were growing under exactly the same conditions. The plants were in a healthy normal state, unless otherwise stated. Temperatures of soil or air to which these plants were subjected cannot be ascertained, since no such records were made at the nursery in which these plants were growing.

***Abies cephalonica*, Loud.**

1' to 2' spread; 90% foliage and 40% growth killed.

***Abies concolor*, Lindl. & Gord.**

1' to 1½' high; 50% foliage and 10% growth killed.

Abies balsamea, Mill.

1' to 2' high; 5% growth at tip killed.

Abies Fraseri, Poir.

Specimen 6' to 7' high; 10% foliage and growth killed.

Abies homolepis, Sieb & Succ.

2' to 3' tall; all new foliage and 10% branch growth killed.

Abies lasiocarpa, Nutt.

1' high; 5% foliage killed.

Picea Abies, dwarf variety.

Low 2' to 3' spreading; 25% foliage and branches killed.

Picea Abies, dwarf variety.

Low 2' spreading specimen; whole south side, representing 50% of plant killed.

Picea Abies, dwarf variety.

Twenty per cent of all vegetative growth killed.

Picea Abies, Karst.

4' to 5'; unhealthy specimen 90% killed.

Picea Koyamai, shiras.

1' to 2' high; 20% foliage and branches killed.

A number of 4' to 5' plants of *Picea Abies* were not affected. It is interesting to record the following species, which were not susceptible to intense heat during this period:

***Picea Abies pendula*, Nash.**

***Picea Engelmanni*, Engelm.**

***Picea glauca Albertiana*, Sarg.**

***Picea glauca nana*, Rehd.**

***Picea polita*, Carr.**

***Picea pungens glauca*, Beiss.**

***Picea omorika*, Purkyme.**

***Picea Smithiana*, Boiss.**

***Chamaecyparis obtusa Crippsii*, Rehd.**

Small plants 6'' to 8'' high; received a foliage and branch kill from 50% to 100%.

***Chamaecyparis pisifera plumosa aurea*, Beiss.**

6'' to 12'' high; healthy plants injured 50%, while unhealthy plants were killed 100%.

***Chamaecyparis pisifera sulphurea*, Schelle.**

6'' to 12''; received 50% injury to foliage.

***Chamaecyparis pisifera squarrosa*, Beiss & Hohst.**

6'' to 12''; 10% tip burn only.

The following did not receive the slightest injury:

***Chamaecyparis pisifers*, Endl.**

***Chamaecyparis filifera*, Beiss.**

***Chamaecyparis Lawsoniana allumii*, Beiss.**

***Thuja occidentalis Boothii*.**

2' to 3' high; 25% of foliage killed.

***Thuja occidentalis Vervaeneana*, Gord.**

6'' to 10''; received 20% tip burn.

Growing in the same nursery rows, but uninjured, were the following:

***Thuja occidentalis globosa*, Gord.**

***Thuja occidentalis Rosenthalii*, Ohlen.**

***Thuja orientalis*, L.**

***Thuja orientalis*, Rosedale hybrid forms.**

***Pinus densiflora umbraculifera*, Mayr.**

5' to 6' high; 15% terminal growth killed.

Pinus Thunbergii Parl., *Pinus sylvestris*, L., *Pinus Banksiana*, Zucc. and *Pinus taeda*, L. were uninjured.

***Cephalotaxus drupacea*, Sieb & Zucc.**

Low spreading, 1' to 1½' wide; received 50% to 90% foliage kill.

***Juniperus Chinensis Pfitzeriana*, Spaeth.**

Two old and large specimens growing nearby on sodded land received 10% branch tip burn of the highest branches that resembled the effect of an open flame, but no permanent injury resulted. Younger plants of *Juniperus Chinensis*, L., *Juniperus virginiana*, L. and *Juniperus communis*, L. forms, growing in the more exposed nursery were not injured.

Tsuga dumosa, Sarg. (*Tsuga Brunoniana*, Carr.) Two-year-old seedling plants, growing in a shaded cold frame, were 100% killed, while older specimens of such species as *Tsuga canadensis*, Carr., *Tsuga caroliniana*, Engelm., *Tsuga diversifolia*, Mast. and *Tsuga Sieboldii*, Carr., were unaffected. It may also be of interest to record *Taxus cuspidata*, Sieb & Zucc., and *Tsuga cuspidata nana*, Rehd., two of our hardiest types of evergreens, were also unaffected by this abnormal climatic condition.

GROWTH PROMOTING ACTION OF ETHYLENE AND OF OTHER CHEMICAL SUBSTANCES*

THE INJURIOUS EFFECTS of the gases ethylene, acetylene, propylene and carbon monoxide, on plant growth were summarized in the last number of the Bulletin.

That these gases in some instances change the aspect of plants, by modifying the distribution of growth, was illustrated in the changed position of leaves of the tomato, causing them to turn down (epinasty).

Crocker, Zimmerman and Hitchcock, at the Boyce Thompson Institute for Plant Research, listed 202 sorts of plants, and found that 89 sorts showed this bending down of leaves under the action of the four gases named when the right concentrations were used. A test of 38 gases and vapors showed that only those named produced this extreme typical effect.

Recently investigations in Europe and in America have shown that a similar effect may be induced by a number of non-gaseous substances when applied to plants in water solution, or in mixture in wool fat (lanolin). The best known of these non-volatile substances is one found by European investigators and known by the name of hetero-auxin. Hetero-auxin, (indole 3-n-acetic acid) phenylacetic acid, and naphthalene acetic acid, as well as some other acids and derivatives of these heterocyclic groups, call forth the responses. The leaf response (epinasty) is produced typically by several of these growth-promoting materials.

The four gases named induce mature cells of plants to resume the embryonic condition seen in the growing state. This is specially true of the cortex cells lying near the surface of the stem or root. These rejuvenated cells increase in number and grow in size producing swellings (intumescences). Dr. Wallace has shown that one part of ethylene gas to 100,000,000 parts of air will induce intumescence formation in apple twigs. Assuming that the ethylene dissolves in the sap of the apple twig in the same proportion that it dissolves in water, it seems that the minimal concentration of ethylene needed to produce intumescences would be one part by weight in 650,000,000,000 parts of apple twig. This is probably the most sensitive biologi-

* Abstract of a part of Dr. Crocker's lecture delivered at the Arboretum on April 11, 1936.

cal response to a chemical substance known to date. On a percentage weight basis, ethylene is nearly 10,000 times as effective as hetero-auxin, and on the molecular concentration basis, about 1000 times as effective. The low concentrations in which ethylene induces developmental changes recall the similar characteristics of vitamins and hormones.

Zimmerman and Hitchcock have recently shown that hetero-auxin and other indole, phenyl and naphthalene compounds that produce physiological effects similar to hetero-auxin, produce intumescences much as do the four gases mentioned above.

The presence of traces of ethylene induces many chemical changes in plants. It hastens the decomposition of the characteristic green pigments (chlorophyll) in the leaves and other living tissues. This property is made use of commercially to hasten the coloring of citrus fruits, the blanching of celery, the ripening of bananas, tomatoes and other fruits.

Zimmerman, Crocker and Hitchcock first discovered the profuse initiation of roots by a known and single chemical, carbon monoxide, a property shown later to be shared with the four gases mentioned before. The same property was found to belong to the water-soluble indole, phenyl and naphthalene compounds already mentioned. The practical value of this property in commercial plant propagation seems likely to have great significance. These substances induce profuse root initiation, apparently speeding up the rooting processes, aiding in the case of plants hard to propagate by cuttings. It is possible that in some cases this may supplant the use of grafting and budding methods. In practice, the water solutions of the non-volatile chemicals or suspension of the chemicals in wool fat (lanolin) are preferable to the use of the gases because their action can be thus localized to places where roots are wanted and small quantities of the materials produce the desired results.

The prolonged effect of these growth-promoting substances may reduce growth after having once started it. Hence, proper concentrations of these substances and times of exposure of the cuttings to the solutions have to be worked out if the helpful action alone is to be gained. The starting of root hairs, as well as of roots, is favored by the gases named.

Studies by a number of investigators show that ethylene is produced normally by various plant tissues and organs, including apples, potatoes, celery, and even by

flowers and by leaves and stems of plants, and it seems logical to conclude that it acts in some plants as a natural hormone.

SUMMARY

Three general groups of substances in illuminating gas and their effects on plants have been discussed.

Hydrocyanic acid dissolves in the water of the soil and kills the root system of the trees. Gas companies can reduce the amount of injury done to trees by illuminating gas by scrubbing the gas free from hydrocyanic acid. After hydrocyanic acid has accumulated in the soil, its rate of disappearance can be hastened by aerating or leaching the soil. It also gradually disappears from the soil due to action of organisms.

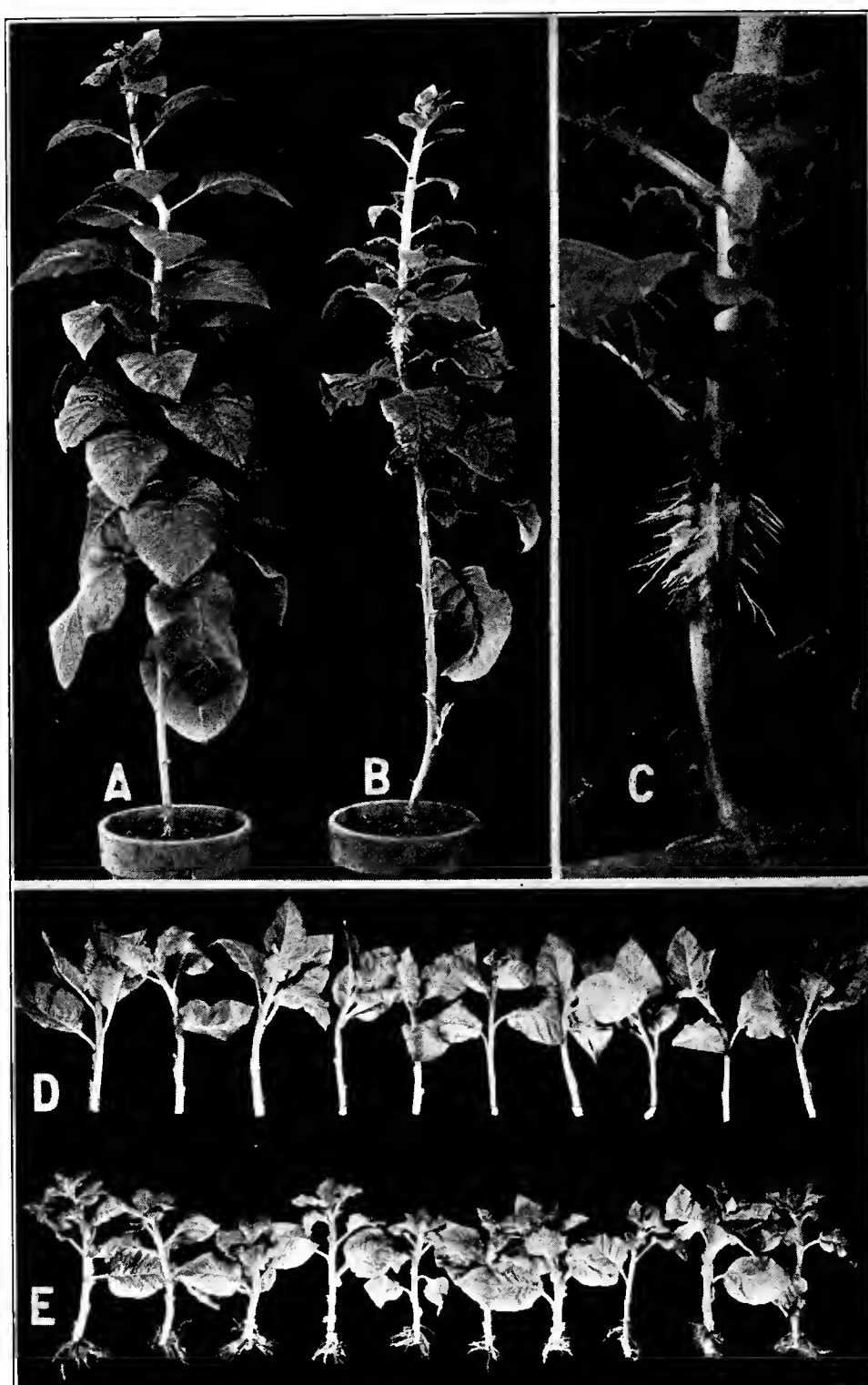
Condensation of drip oils in the soil constitutes the second greatest source of injury to trees in the soil. The less volatile of these remain in the pipes or in the immediate region of the leak. Their removal from the soil can be hastened by aeration and naturally occurs by volatilization.

The third group of substances considered are the gases which show low solubility in water. Amongst these, four unsaturated carbon-containing gases (ethylene, acetylene, propylene and carbon monoxide) are of special interest because of their anaesthetic and stimulative effects on plants. Ethylene is of special interest because of the extremely low concentrations in which it shows anaesthetic and stimulative action.

The anaesthetic effects of these four gases are manifested by partial or complete growth rigor. The following stimulative effects are outstanding: induction of epinasty of petioles, induction of intumescences, initiation of roots and root hairs. In the anaesthetic effects and especially in the stimulative effects, the four gases act similarly to hetero-auxin and other non-volatile, growth-stimulating and modifying substances.

Ethylene is produced by various plant tissues and probably acts as a natural hormone in plants.

WILLIAM CROCKER



LEGENDS FOR FIGURES

Figure 2

Nicotiana tabacum (Turkish variety) exposed to one per cent carbon monoxide gas. A. Control plant kept in Wardian case. B. Plant exposed to gas 15 days, then allowed to stand in air two days, after which time it was photographed. C. An enlargement of the rooting region of B. D. Tobacco cuttings from control plants in Wardian case for 10 days. Photographed 5 days after having been placed in rooting medium. E. Cuttings from plants treated with one per cent carbon monoxide for 10 days and then placed in rooting medium for 5 days, after which time they were photographed.

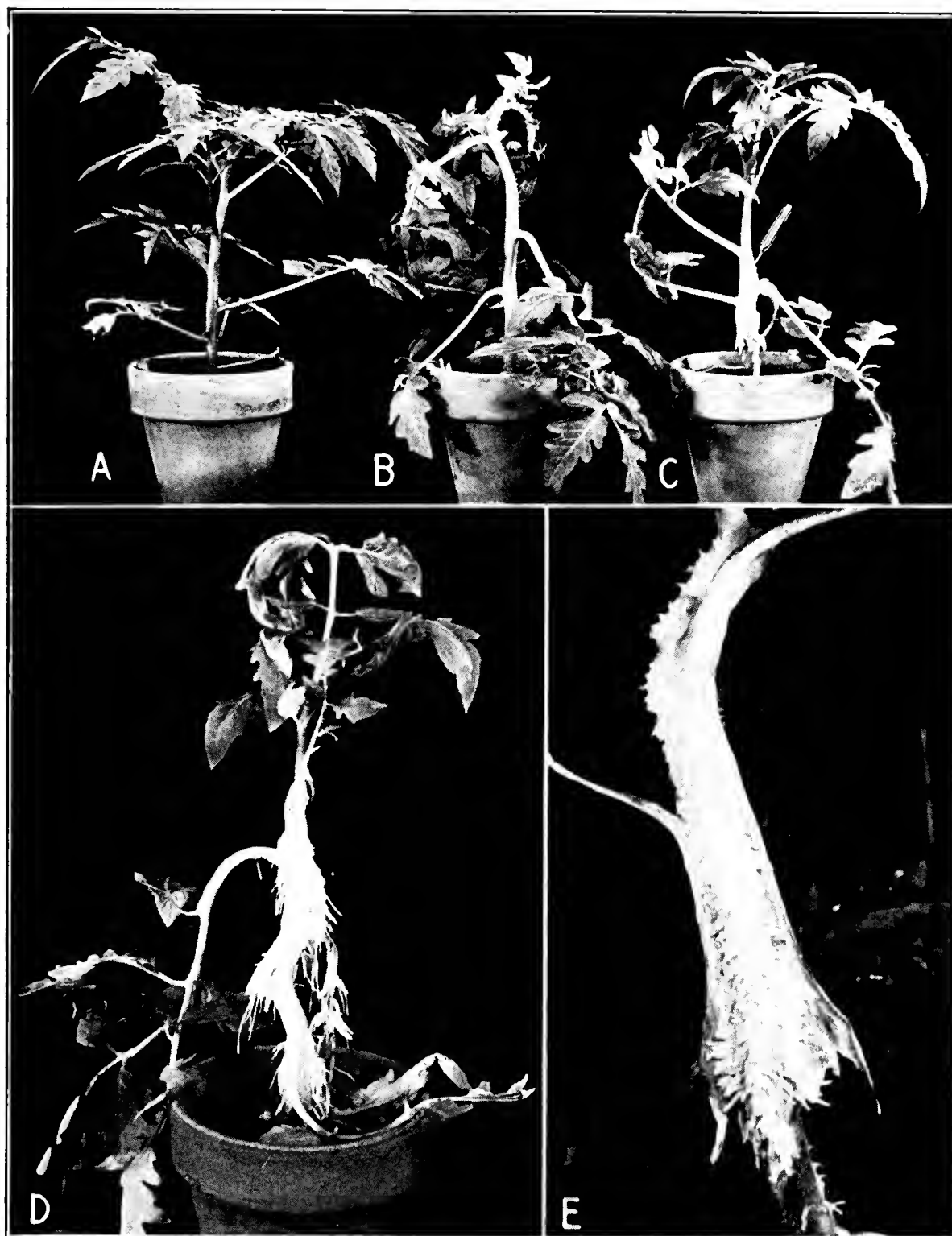


Figure 3

Tomato plants treated with growth-promoting substances. A. Control. B. Plant 24 hours after treatment along the stem with lanolin paste containing one per cent α -naphthaleneacetic acid. C. Approximately 0.4 cc. of 0.01% α -naphthaleneacetic acid in water injected by means of a glass tube caused local epinasty and initiation of roots; appearance after 8 days. D. Stem and leaves of plant treated with lanolin paste containing 2.0 per cent α -naphthaleneacetic acid. E. Adventitious roots on stem 14 days after treatment with 2.0 per cent indoleacetic acid.

EROSION

EVER SINCE the solid ground rose above the waters, two groups of forces have been at work on it. One has for its net result face-lifting, with the elevation of mountains, plateaus, and other high places; the other has resulted in the lowering of the land. The processes that have worn down the land are now attracting much attention on account of the tremendous influence that they are recognized to have on the fate of us humans.

Weathering processes, such as heat and cold and the dissolving action of water, have broken down the rocks into fine particles that have become subject to the action of the forces of erosion, wind and water. The movements of air currents, winds, pick up these rock particles and carry them as dust as long as the force of the wind will permit. Then they are deposited as the wind speed falls, the heavy particles being deposited first, the finer ones later. Sometimes the finest particles are carried into the upper levels of the atmosphere, where they continue to travel long distances as dust clouds. During the past dry seasons, the fine farm soils of the wheat belt beyond the Mississippi have clouded the skies of the Eastern States, and winds have even borne the dust hundreds of miles out over the Atlantic Ocean. Vast quantities of productive farm soil have been carried away, and vast damage has been done to American agriculture.

The impact of falling raindrops on unprotected surfaces, especially when driven by wind, dislodges soil particles, suspends them, and, as streams begin to form, transports these loose particles downstream. Thus, on unprotected soil surfaces, on farm lands in which the handling of the soil leaves it subject to wash, the valuable top soil, in which farm and garden plants grow, tends to wander with the flowing water. As the water begins to form larger and larger streams, the action becomes more and more pronounced and injurious. Gulleys begin to form, and these widen and deepen, forming gutters that tend to work back into the adjoining areas. The transported particles, carried along in the muddy stream, are deposited as the force of the current is reduced, the heavier particles being dropped first, forming gravel banks, sand bars and silt beds. Finally, the smallest particles slowly settle in standing water. By this general process, the farm soil of the upper waters of the river basins

is removed, sorted and deposited along the lower stretches of the rivers, interfering with navigation, silting up reservoirs, or spreading out over inundated flat lands. Much may even go out to sea to form deltas at the mouths of the larger rivers.

The processes of wind and water erosion have been going on since the rocks forming the earth's surface were weathered into transportable particles, but the plant cover of grasses, shrubs and trees protected the soil to a great degree. With the clearing away of the forests, with bad soil management by the farmer, with the over-grazing of the grass lands, with damage to the protecting forest and sod, the soils of this country from which we get food, fibres, timber, and endless products used in manufacture, are being damaged to an extent that is almost appalling.

A soil survey reported by Sears (Deserts on the March, p. 99) classified the soils of the country according to their quality for agricultural use. The results are as follows:

Excellent —	5.3 per cent	Poor	—19.1 per cent
Good	—11.1 “ “	Unfit	—46.4 “ “
Fair	—18.1 “ “		

Of course, much of the *unfit* land has not become so through erosion, e.g., marsh lands, mountain areas, and others. This survey reveals a situation that has hardly been more than suspected.

The remedy for eroded lands lies partly with engineering work that shall have for its aim the retarding of the flow of water, with an increase in the quantity of water absorbed and stored in the ground; partly with the user of the soil, who should so plow his furrows as to hinder the flow of water, and who should plant and handle his crops with this same object in view. The planting of trees to retard the formation and flow of streams at the head waters and to promote absorption by the soil of water at the point of rainfall, is an important upstream measure. Trees by their root systems help to hold the soil on woody slopes. Grasses everywhere, by retarding stream formation and stream flow, and by the retaining action of their fibrous root systems, give most important protection.

R. H. T.

WINTER LECTURES

THE WINTER lecture course to be given at the Arboretum during the coming season will deal with the general subject of "Flowering Trees and Shrubs." Speakers specially equipped to deal with these groups have been obtained and all persons in these types of plants will find the lectures worth hearing.

The schedule of dates, subjects and speakers follows:

December 12, 1936.

MR. JOHN C. WISTER *Lilacs*

Mr. Wister is Secretary of the Pennsylvania Horticultural Society, Director of the Arthur Hoyt Scott Foundation of Swarthmore, and author of several well-known books.

January 9, 1937.

DR. L. M. AMES *Barberries*

Dr. Ames, attached to the Bureau of Plant Industry, of the U. S. Department of Agriculture, has been carrying on extensive investigations at the Arnold Arboretum, of Boston, Mass.

February 13, 1937.

MR. A. D. SLAVIN *Magnolias*

Mr. Slavin comes to us from Des Moines, Iowa, where he is engaged in work with the National Government. He will be remembered for his earlier work at the Arboretum of Rochester, New York.

March 13, 1937.

DR. GLEN P. VAN ESELTINE *Flowering Crab Apples*

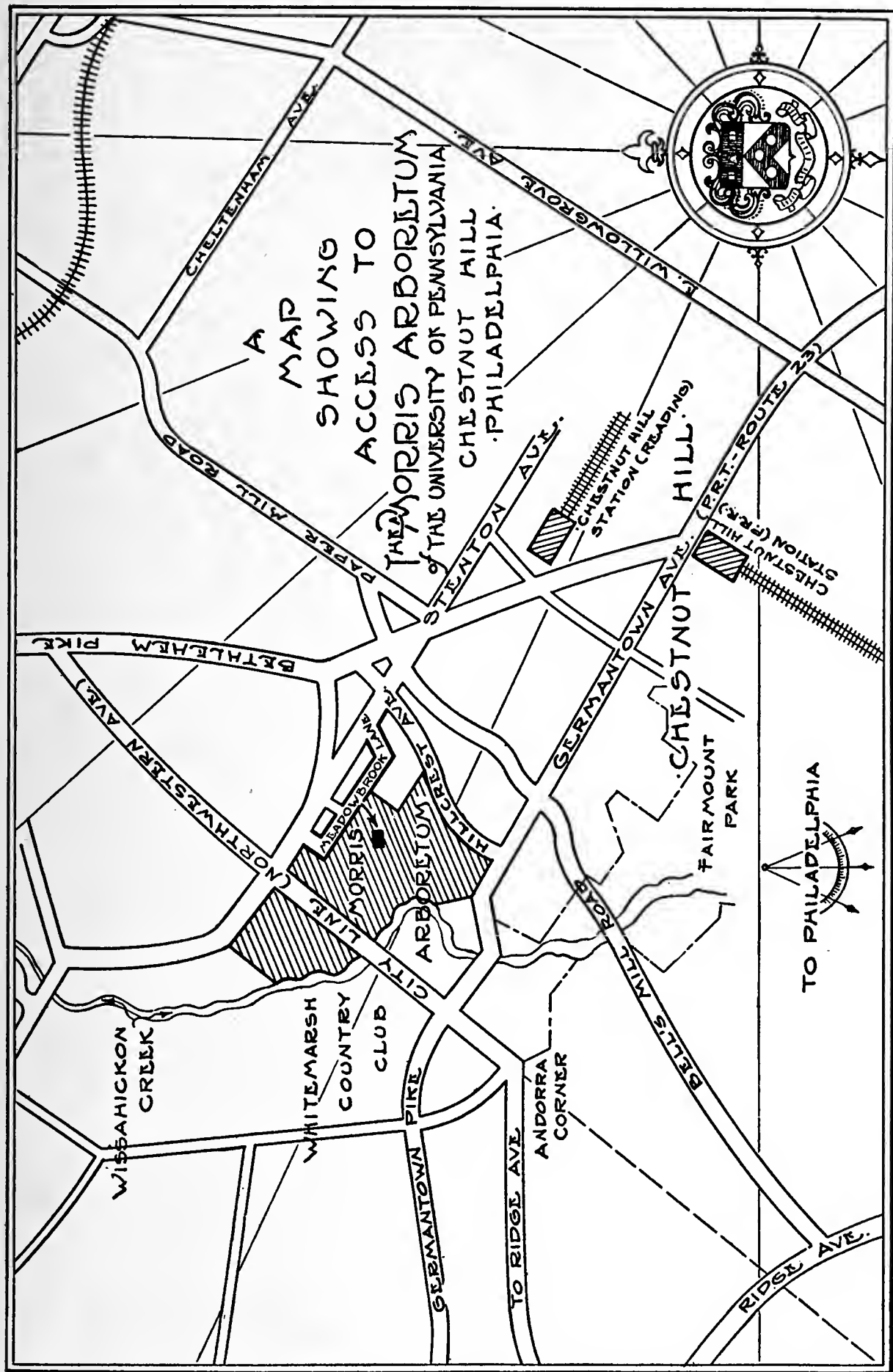
Dr. Van Eseltine is now connected with the Horticultural Department of the New York Agricultural Experiment Station at Geneva, New York. His publications on the subject of his lecture will be recalled.

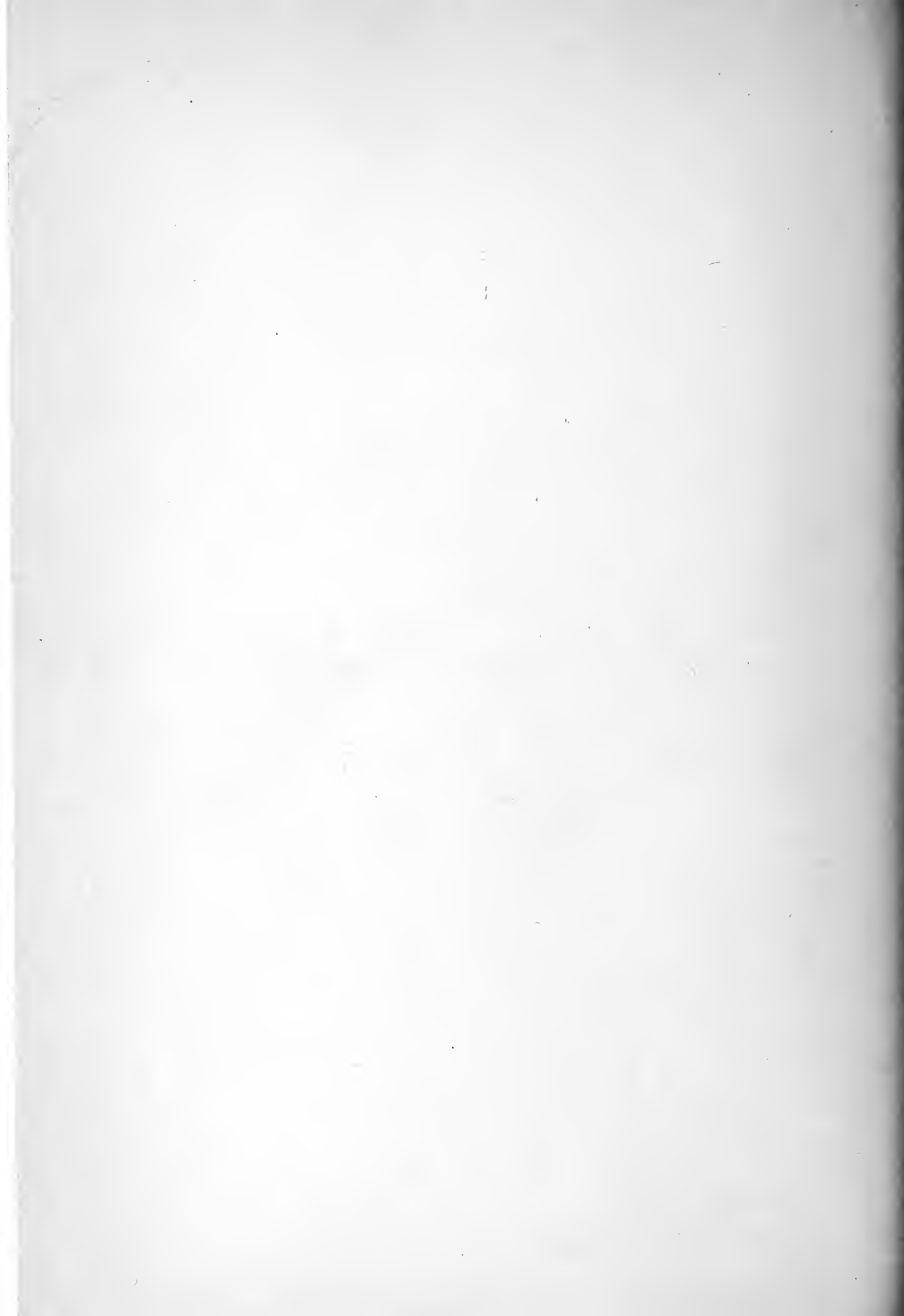
April 10, 1937.

DR. DONALD WYMAN *Flowering Trees and Shrubs Pictured in Their
Order of Bloom*

Dr. Wyman comes from the Arnold Arboretum at Boston, with a remarkable exhibit of slide illustrations in natural colors that have been developed there at much expense of time and money.

Lectures will be given at 2:30 P. M. on the second Saturday of the month, at the Arboretum. Entrance by the Meadowbrook Lane gate.







ARBORETUM BULLETIN
OF THE
ASSOCIATES

APRIL, 1937

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THE
MORRIS ARBORETUM
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Himalayan Pine
Pinus excelsa Wall.

The frontispiece represents a Himalayan Pine (*Pinus excelsa* Wall.) growing in the Morris Arboretum. This handsome pine, marked by its drooping leaves, is a native of the Himalayan region west of Afghanistan. It is grown in this country as an ornamental, supposed to be hardy in sheltered situations as far north as Massachusetts (Bailey).

This tree sometimes attains a height of 150 feet, forming a broad loose open top of great beauty. The bluish-green leaves, 6 to 8 inches long, are borne in clusters of 5 in a fascicle. The cylindric gray-brown cones are from 6 to 10 inches long.

The variety *zebrina* Bailey has leaves variegated by a whitish zone. Both types are represented at the Arboretum.

The photograph was taken by Gustave Liebscher.

RODNEY H. TRUE

BARBERRIES*

—BY—

DR. L. M. AMES

U. S. Department of Agriculture

DR. AMES outlined the history of the common barberry, *Berberis vulgaris*, and the story of its relation to the rust of grains. Native in the mountains of central and western Asia, it found its way into Italy and Spain in the seventh century, where its showy berries, supposed medicinal qualities and the dyeing properties of the inner bark and stem brought it into cultivation. It was not introduced into Northern Europe until the seventeenth century, when it was brought by early colonists to America. Here it was planted out as an ornamental shrub, yielding berries used in making jams, jellies and wine, and a yellow dye from the inner bark. It is said that the leaves were used in tea and salads, and the slender tough stems for rake handles and similar purposes. Its thorny shrubbery was useful for hedge and fence purposes.

It was not long, however, before an injury to cereals growing near the barberries began to attract attention, both in America and in Northern Europe. Laws restricting its use were passed in Connecticut, Rhode Island and Massachusetts between 1726 and 1766. Similar laws were passed in several European countries shortly after 1800. The first well-directed effort on record to demonstrate the supposed relation of the barberry to the grain disease was made by the English horticulturist, Knight, in 1804, and his results were confirmed by the German, De Bary, in 1865, who proved beyond doubt a relation to exist. The distribution of the barberry in America followed the covered wagon, and birds and other natural agencies aided the efforts of man.

The barberry came into Lackawanna and Susquehanna counties in Pennsylvania in 1737, when the Vail and Drumm families brought it from Massachusetts. It has been growing in the Cumberland Valley not less than a century. By 1916, the recognized damage to the wheat crop reached such proportions (184,000,000 bushels) that systematic efforts were soon begun to eliminate this shrub from agricultural areas, an effort that is still increasing in intensity and widening in area.

Fortunately, there are species of this valuable group that do not carry the rust disease and the common barberry can be replaced in horticultural relations by other beautiful types.

The genus, *Berberis*, contains over 500 described species, of which but two are

* Summary of lecture given January 9, 1937, at the Morris Arboretum of the University of Pennsylvania.

native to the United States: *Berberis fendleri* Gray and *B. canadensis* Mill., both susceptible to rust infection. *B. fendleri* is native in Colorado and adjacent regions. A cross with *B. canadensis*, named *B. rehderiana*, has been described. *Berberis canadensis* Schrad. is native in the general region extending from Virginia to Georgia westward to Missouri. This shrub has been quite generally distributed. *B. vulgaris* is sometimes cultivated under this name.

Many crosses of *B. vulgaris* exist, four with *B. siberica*, one with *B. veitchii*, one with *B. aristata*, one with *B. heteropoda*, three with *B. chinensis*, one with *B. canadensis*, one with *B. Thunbergii*. Many of these have received specific botanical names. In addition, there are several varieties distinguished as follows:

***Berberis vulgaris* var. *albo-variegata*.**

Leaves margined with white.

***B. v.* var. *argento-marginata*.**

Leaves margined with white.

***B. v.* var. *aureo-marginata*.**

Leaves margined yellow.

Leaves deeply purple.

***B. v.* var. *atropurpurea*.**

***B. v.* var. *lutea*.**

Fruit bright yellow.

***B. v.* var. *alba* (var. *leucocarpa* K. Koch).**

Fruit white or yellowish.

***B. v.* var. *enuclea* (var. *asperma* Willd.—var. *apyrena* Schrad.).**

Fruit without seeds.

***B. v.* var. *dulcis*.**

Fruit sweet or but slightly acid.

Many of the *vulgaris* hybrids are being grown in the Eastern and North Central States.

The best known and by far the most extensively cultivated barberry at this time is the common Japanese barberry (*Berberis thunbergii*, DC.). Several hybrids of this species are worthy of mention and of cultivation:

***Berberis thunbergii* var. *maximowiczii*.**

Leaves usually acute and green beneath.

***B. t.* var. *argento-marginata*.**

Leaves variegated with white.

***B. t.* var. *minor*.**

Low, dense form.

***B. t.* var. *plurifolia erecta*.**

Dense, upright form.

B. t. var. purpurea.

Leaves purple.

B. t. plurifolia (B. ottawensis).

Flowers umbellate to racemose.

Hybrid: **B. thunbergii x vulgaris (Berberis ottawensis).**

B. thunbergii x julianae (B. mentorensis).

The most variable of the ones mentioned above are those derived by hybridization. *B. ottawensis* has been sold extensively throughout the country. Though immune itself to rust, some of its seedlings through segregation give rise to susceptible *vulgaris* types. Some of the newer types deserve special mention:

Berberis thunbergii var. pluriflora erecta adds to the merits of the species an upright habit of growth making it suitable for formal hedges. It colors well in the fall, and the bright red berries cling to the bush far into cold weather.

Berberis circumserrata, a little-known type from northwestern China, is a remarkably attractive shrub, with large, yellow-red tapering fruits, borne in clusters from one to five in a long peduncled raceme. It has not yet found its way into the trade.

Berberis gilgiana, likewise from northwestern China, is one of the few pubescent types. The berries become brilliant red.

All Barberries do not have red berries, some bearing black or purplish fruit. *Berberis heteropoda* from Turkestan, introduced about 1875, has very juicy, pear-shaped fruits. *Berberis turcomanica* var. *integerrima* has smaller fruits of very marked color. The leaves have a peculiar light hue, marking it distinctly from other species.

Among the evergreen barberries, the rust-resistant *B. julianae* is characterized by stiff upright stems, bearing dark-green glossy leaves and very long spines that make it a hedge plant of great beauty, also a protective barrier against man and beast.

A brief mention was made of the related genus, *Mahonia*, from the Pacific Northwest. *Mahonia Aquifolium*, the Oregon grape, brought from the Pacific Northwest by the Lewis & Clarke Expedition, is either immune or highly resistant to the rust. The glossy, divided evergreen leaves are variable in form. The long racemes of bright yellow, fragrant flowers are followed by purplish, edible fruits.

Mahonia repens differs in being procumbent. Both are useful as ground cover under shrubs or trees, or in places not exposed to bright sunlight during freezing weather.

The Barberry family offers about 30 harmless species and varieties of beautiful shrubs that can be grown anywhere in the United States.

Reported by RODNEY H. TRUE

MAGNOLIAS*

—BY—

ARTHUR D. SLAVIN

THE GENUS *Magnolia*, named in 1715 for Dr. Pierre Magnol, director of the botanical garden at Montpellier, France, is native in the wilds of Asia, from which region many of the present horticultural forms were obtained, and in parts of North America.

Magnolias make up one of the finest groups of flowering trees and shrubs available to gardeners. The variety in form, stature, time of flowering, and in color, make the group one of great beauty and dignity.

Magnolias are not particular as to soil conditions, if an abundance of plant food is available, and if the location is well-drained. Both drought and wet feet are injurious. They need no pruning, and do best if planted where they are to remain. In transplanting, small plants with root systems well-balled and burlapped should be used.

Propagation has become a common practice in this country. Hybrids and special forms are generally grafted, although budding is also practiced. If skillfully performed, budding is the preferable method. The choice of stock is important. European practice often calls for *Magnolia liliflora*, a species tender in this country. In this region, *Magnolia tripetala* is sometimes used with uncertain results. The best stock is *Magnolia Kobus*, of the *borealis* form, producing vigorous plants with little or no trouble from suckering. Layering, producing self-rooted plants, would be the favorite method were it not so slow and were the number of plants produced at a time greater. With species seeds are still the accepted method of reproduction.

Magnolias are subject to serious attack by but one insect, a scale large enough to be readily seen by the unaided eye. These scales look like brown leather spots on branches from one to three years old. If allowed to spread, the main stems may be attacked. Miscible oil and nicotine soap solutions are most effective but should be used with great care lest the leaves and young branchlets be burned. The insect should be sought from the first of June until September. If it appears, all infected parts should be scrubbed off with a toothbrush or other soft scrubbing implement, using a weak solution of soap chips.

The floral succession of Magnolias begins with the star Magnolia, *Magnolia stellata*, from Japan. Flowers appear before the leaves, opening a multitude of white, star-like flowers, over three inches in diameter, in the latter part of April. This

* Summary of lecture given at the Morris Arboretum, February 13, 1937.

species may reach the size of a small tree and is hardy throughout the country. Equally, if not more important, is the form *rosea*, having pinkish petals.

As this species passes its best, the pure white flowers of the Anise Magnolia, *Magnolia salicifolia*, appear. The fragrance of the crushed leaves gives it the common specific name; the willow shape of the leaves gives it the Latin specific name. It is a small tree that may reach a height of 20 feet, having a rather narrow habit of growth.

Magnolia Kobus blooms at the same time as the Anise Magnolia. One form, shrubby in habit, comes from Hondo in Japan; the other, more tree-like, known as the variety *borealis*, comes from Hokkaido and North Hondo. The smaller type flowers while young, the taller type only after it reaches a height of almost 15 feet. How tall it may become is not known, since it has been in cultivation here only 40 years and has never in that time stopped growing. It has a broad top, branching from near the base, with a short stocky trunk and smooth, dark-grey bark. The flowers are white, often more than five inches in diameter.

The rich purples of garden forms are derived entirely from hybrids of the Chinese *Magnolia liliflora*. It does well at Rochester, New York, in sheltered locations, but is not hardy unless judiciously planted. The species, unlike most of its hybrids, remains a broad shrub, 8 to 12 feet in height, with delicate, vase-shaped purple flowers appearing during the first week in May. The form *nigra* has larger flowers, with petals deep purple on the outer side, pale lavender within. It blooms more prolifically than the type, is larger, and is entirely hardy.

Magnolia denudata, the Yulan magnolia, blooms shortly before the purple type just described. During the first days of May, the large, bowl-shaped, creamy-white flowers crown every branch and spread a fine aroma. Full-grown specimens are broad, sometimes occupying an area 50 feet in diameter. It is best planted as a specimen tree in a spacious lawn. A beautiful rose-red form, found in China by Wilson in 1901, is not to the speaker's knowledge in cultivation in this country.

Magnolia soulangeana, a cross between *Magnolia liliflora* and *Magnolia denudata*, in its many forms offers a profusion of bloom and of color, from the time of the appearance of flowers on *Magnolia Kobus* until the Yulan magnolia blooms. This cross is one of the earliest important plants produced by artificial crossing. The Yulan magnolia, fertilized by pollen from *Magnolia liliflora*, produced its first flowers in 1826. It was a true intermediate type. Innumerable crosses have since been made with a wide range of colors, from almost pure white to dark purple. The character of the original hybrid cannot be definitely known. Variations in this wide group chiefly concern color, size of flower, and time of flowering. *Alba* blooms first, succeeded by *Norbertiana*, *Andre Le Roy*, *Verbanica*, *Brozzonii* and *speciosa*. *Lennei* is the best of the deep purple types.

The remaining members of the family produce their flowers after the leaves have appeared.

The large native tree, *Magnolia acuminata*, the cucumber tree of the Eastern States, blooms in the last week of May. This species is most valued for its size, form and foliage. It reaches a height of 60 to 80 feet. The brilliant scarlet seeds, dangling from the pickle-like fruit, gives this species a special interest.

Magnolia Fraseri, from the Southern States, has leaves often 18 inches long, broad at the apex, narrowed at the base to an earlike lobe on each side of the leaf-stalk. The flowers are creamy white, fragrant, from 10 to 12 inches across. The average size of cultivated specimens is from 20 to 30 feet.

Magnolia obovata, from Japan, having large, obtusely-pointed leaves and pure white flowers, although hardy in Rochester, New York, is not likely to reach the size seen in the wild state in Japan, 90 feet.

Magnolia tripetala, the umbrella tree, native from Southern Pennsylvania to the Gulf, is a medium-sized tree with large leaves and white, good-sized flowers that give off a sickish, sweet aroma.

Magnolia macrophylla, of the Southern States, bears the *largest* leaves of any tree capable of cultivation in the North. Sometimes a length of 30 inches is attained. The flowers, although somewhat hidden by the leaves, may reach a diameter of 12 inches. It flowers early in June.

Some of the most beautiful flowers seen among the Magnolias are found in the late-blooming types, which open after the spring riot of color is over. Unsurpassed for beauty by rose, rhododendron or peony, *Magnolia parviflora*, the tulip magnolia, is most valuable. Large, tulip-shaped flowers dot the plant with pure white blooms, having brilliant, crimson-colored centers made up of stamens. Seldom more than 10 feet high, this species is not only among the best flower-producers in June, but one or two blooms can be found on a healthy plant throughout the summer. It is usually grown as a specimen plant.

Magnolia Watsonii has practically disappeared from cultivation in this country, although formerly found here. It is to be seen in England as a tree-like shrub about 14 feet tall. The fragrant flowers are similar to those of *Magnolia parviflora*, but at times reach a diameter of five inches, with thick petals in saucer-shaped arrangement around a red center.

Magnolia Wilsonii, a comparatively late introduction by Dr. Wilson, has not yet had time enough to be well-known.

The smallest member of this family, *Magnolia virginiana*, the sweet bay of our wet lands, is a shrub about eight feet tall in the North, although a small evergreen

tree in the South. The fragrant, creamy-white flowers open early in June. The leaves are glossy on the upper side and distinctly grayish underneath.

One species, *Magnolia grandiflora*, is a broad-leaved evergreen in the South, where it reaches the size of a large forest tree, having large, lustrous dark foliage. Its growth habit is pyramidal. It is grown successfully as far north as Philadelphia, and is much in evidence in Washington as a tree reaching a height of about 30 feet. Large, fragrant white flowers appear in June, but the blooming period is somewhat dependent on climatic conditions. Flowers may be seen from May until August.

Summarized by RODNEY H. TRUE



THE BARBERRIES AT THE ARBORETUM

—BY—

JOHN C. SWARTLEY

A FAIRLY LARGE collection of these spiny, but intensely interesting shrubs, was established here while Mr. John T. Morris was still living. This collection can be found directly north of the Pond, on the hillside leading up to the Mansion. Some types, either slow-growing or tender, appear like infants, while others range in size to the master of them all—a *vulgaris* hybrid about ten feet tall, with nearly a fifteen-foot spread and branches borne to the ground with bunches of heavy fruit.

The exact date of this first planting is uncertain, for few records have come to light, but we are reasonably sure that we have here between 30 and 35 shrubs that came from the Arnold Arboretum nearly thirty years ago. These represent at least 20 different species, varieties and hybrids, not all of which have been determined at the present writing.

There are several worthy of note. The evergreen varieties include *Berberis ilicifolia* (10), richly colored, at the top of the group; *Berberis Gagnepainii* (8), a straggly shrub on the side toward the formal garden; *Mahonia Aquifolium* (1) a fine specimen in the center; *Berberis Julianae* (12), farther toward the Pond, entirely unharmed by cold until last winter and still a very decent shrub, and *Mahonia Bealii* (2), which has been almost vanquished by the severity of recent winters. Deciduous species include *Berberis amurensis japonica* (22) with large leaves and extremely red fruits, *Berberis Sieboldii* (49) with a somewhat straggly form, but graced with interesting leaves and many red fruits; *Berberis ottawensis* (72) a hybrid between *Berberis Thunbergii* and *Berberis vulgaris*, which is a medium-sized shrub distinguished by many panicles of fruit and spreading, vase-shaped form; *Berberis vulgaris* (60) in many beautiful forms, including one with yellowish fruit, and *Berberis*

(Numbers refer to check-list of species and varieties at end of article.)

provincialis (71), a hybrid between *Berberis vulgaris* and supposedly *Berberis sibirica*. These range from small, shiny-leaved forms to large, coarse-leaved ones, very similar to *Berberis vulgaris*, giving a good illustration of the range from one parent to the other.

The second large group of Barberries is located below the cottage along Germantown Avenue. These number between 45 and 48 individuals, with about 25 different species, varieties and hybrids. Most of them came from the Arnold Arboretum on November 6, 1912, with some from the Bureau of Plant Industry. Nearly all were marked only with numbers, and of these many have been lost or mixed, although a few can be traced directly to collections in China by E. H. Wilson. According to a list in our possession, 20 different numbers, comprising about 17 different species and varieties, were sent to Mr. John T. Morris on the above date.

In this group one finds a great variation in form, coloration of berries and leaves, the berries of some starting to color only a few weeks after the flowers disappear. In the fall there is a wonderful display of contrasting shades of red and green, with some shrubs gracefully spreading and others straggly or vase-shaped, but redeemed by the brilliant colors of their numerous fruits.

Here we find *Berberis Dielsiana* (36), with dull green leaves interspersed with clusters of bright red berries and gracefully arching branches; *Berberis dasystachya* (32) with branches more upright, but with many bloomy bluish fruits; *Berberis Gilgiana* (40), one of our rust-resistant varieties, giving a characteristic effect with its slender dark twigs, entire reddish leaves and berries just turning from green to light red; *Berberis Poirerii* (47), a closely-branched shrub, upright, but with a graceful, widespreading top, small bright-green leaves and fruit of very lustrous red; *Berberis diaphana* (33), compact and daintily-leaved; *Berberis Vernae* (58) with many slender drooping branches, and green to light-red berries hanging in chains; *Berberis Wilsonae* (64) formerly a beautiful, widespreading, compact form with small leaves, but now reduced by severe weather; *Berberis aggregata* (19), which is similar to *Berberis Wilsonae*, but has slightly larger leathery leaves, and at the bottom of the group, the most notable of them all—*Berberis circumserrata* (28)—another rust-resistant variety, heavily branched, but fairly low and compact in habit, holding its large red leaves and yellowish-red berries until late in the winter.

Our collection of Barberries has grown considerably since 1932. In the early spring of 1933, some numbers of Barberries collected in the Rock Expedition of 1932 to Tibet were sown, and several different kinds germinated. We have not yet received the determinations for the Barberries, but among our seedlings we have recognized another rust-resistant variety—*Berberis dictyophylla albicaulis* (36)—a striking shrub with whitish wooly branches. According to the Arnold Arboretum Bulletin of Popular Information, issued October 1, 1936, this variety is immune.

In the spring of 1934, and again in 1935, seeds of various species were obtained from different botanical gardens. These include two interesting forms, namely, *Mahonia repens* (5), which really seems to be dwarf, and *Berberis Thunbergii minor* (54), which has come true from seed. Both are immune. This past fall seeds of a few more were collected at Bell Station, Maryland, where one of the Government testing grounds is located. Among them is *Berberis koreana* Palibin, another immune species, which we hope to germinate this year.

Check-List of Barberries at the Morris Arboretum.

Those starred are large, established plants. The rest are seedlings or cuttings of various sizes. In each case the native habitat is given: C—China, N. C. C.—North Central China, etc.

MAHONIA GROUP

- * 1. *Mahonia Aquifolium*, Nutt.—Brit. Col. to Ore.
- 2. *Mahonia Bealii*, Carr.—C.
- * 3. *Mahonia Fremontii*, Fedde.—West Texas.
- 4. *Mahonia nervosa*, Nutt.—Brit. Col. to Calif. & Ore.
- 5. *Mahonia repens*, G. Don.—Brit. Col. to New Mex. & Calif.

EVERGREEN SPECIES

- 6. *Berberis candidula*, Schneid.—C. C.
- 7. *Berberis chitria*, Lind.—Himal. (semi-evergreen).
- * 8. *Berberis Gagnepainii*, Schneid.—W. C.
- 9. *Berberis Hookeri*, Lem.—Himal.
- * 10. *Berberis ilicifolia*, Forst.—S. Chile.
- 11. *Berberis insignis*, Hook.—Sikk.—Himal. (hardy only in cold frame).
- * 12. *Berberis Julianae*, Schneid.—C. C.
- 13. *Berberis Sargentiana*, Schneid.—C. C.
- 14. *Berberis Soulieana*, Schneid.—C. C.
- 15. *Berberis triacanthophora*, Fedde.—C. C.
- 16. *Berberis Veitchii*, Schneid.—C. C.
- 17. *Berberis verruculosa*, Hemsl. & Wils.—W. C.
- 18. *Berberis aetnensis*, Presl.—Cors. & Sard.

DECIDUOUS SPECIES AND VARIETIES

- * 19. *Berberis aggregata*, Schneid.—W. C.
- * 20. *Berberis aggregata*, *Prattii*, Schneid.—W. C.
- * 21. *Berberis amurensis*, Rupr.—N. E. Asia.
- * 22. *Berberis amurensis japonica*, Rehd.—Japan, Korea.
- 23. *Berberis angulosa*, Wall.—Himal.
- 24. *Berberis Beaniana*, Schneid.—W. C.
- 25. *Berberis Boschanii*, Schneid.—W. C.
- 26. *Berberis canadensis*, Mill.—Virg. to Ga. & Miss.
- 27. *Berberis chinensis*, Poir.—Caucas.
- * 28. *Berberis circumserrata*, Schneid.—N. W. C.
- 29. *Berberis concinna*, Hook.—Sikk.—Himal.

30. *Berberis crataegina*, D. C.—Greece.
31. *Berberis cretica*, L.—Greece.
- *32. *Berberis dasystachya*, Maxim.—C. & N. C.
- *33. *Berberis diaphana*, Maxim.—W. C.
34. *Berberis dictyoneura*, Schneid.—W. C.
35. *Berberis dictyophylla* (Franch.) *albicaulis*.
- *36. *Berberis Dielsiana*, Fedde.—W. C.
37. *Berberis Edgeworthiana*, Schneid.
38. *Berberis Faxoniana*, Schneid.—W. C.
39. *Berberis Francisci-Ferdinandi*, Schneid.—W. C.
- *40. *Berberis Gilgiana*, Fedde.—N. C. C.

DECIDUOUS SPECIES AND VARIETIES

41. *Berberis Giraldii*, Hesse.—N. C. C.
42. *Berberis Lecomtei*, Schneid.—W. C.
43. *Berberis Leichtlinii*, Schneid.—C.
44. *Berberis Mouillacana*, Schneid.—W. C.
- *45. *Berberis nummularia* (Bge.) *pyrocarpa*, Schneid.—Turkest. & N. Persia.
46. *Berberis parvifolia*, Sprague—W. C.
- *47. *Berberis Poiretti*, Schneid.—N. C.
48. *Berberis polyantha*, Hemsl.—W. C.
- *49. *Berberis Sieboldii*, Miq.—Jap.
50. *Berberis Silva-Taroucana*, Schneid.—W. C.
51. *Berberis thibetica*, Schneid.—W. C.
52. *Berberis Thunbergii*, D. C.—Jap.
53. *Berberis Thunbergii Maximowiczii*, Reg.
54. *Berberis Thunbergii minor*, Rehd.
55. *Berberis Tischleri*, Schneid.—W. C.
- *56. *Berberis turcomannica* (Karelin.) *integerrima*, Schneid.—Turkest. & N. Persia.
57. *Berberis yunnanensis*, Franch.—W. C.
58. *Berberis Vernae*, Schneid.—N. W. C.
- *59. *Berberis virescens*, Hook.—Sikk.—Himal.
- *60. *Berberis vulgaris*, L.—Eur.
- *61. *Berberis vulgaris atropurpurea*, Reg.
- *62. *Berberis vulgaris lutea*, L'Her.
- *63. *Berberis vulgaris, sulcata*.
- *64. *Berberis Wilsonae*, Hemsl. & Wils.—W. C.
- *65. *Berberis Wilsonae Stapfiana*, Schneid.—W. C.
- *66. *Berberis Wilsonae subcaulialata*, Schneid.—W. C.
67. *Berberis xanthoxylon*, Hassk.—Java.

HYBRIDS

68. *Berberis declinata*, Schrad.—*vulgaris* x *canadensis*.
69. *Berberis laxiflora*, Schrad.—*vulgaris* x *chinensis*?
70. *Berberis macracantha*, Schrad.—*vulgaris* x *aristata*.
- *71. *Berberis provincialis*, Schrad.—*vulgaris* x *sibirica*?
- *72. *Berberis ottawensis*, Schneid.—*vulgaris* x *Thunbergii*.
73. *Berberis Spaethii*, Schneid.—*chitria*? x ?

FURTHER NOTES ON THE DISEASE OF HIMALAYAN PINES

—BY—

JOHN AUSTIN JUMP

CONSIDERABLE ATTENTION was attracted during 1934, in Pennsylvania and New Jersey, by the widespread dying and injury of the Himalayan pine (*Pinus excelsa*). Speciman trees died on several estates in the vicinity of Chestnut Hill, among which was the rare *Pinus excelsa* var. *zebrina*, a variety with variegated needles that grew at the Morris Arboretum.

The winter of 1933-34 was characterized by record-breaking low temperatures, and many plants which were not strictly hardy in the latitude of Philadelphia either died or were severely injured. In some cases this was a direct effect of the low temperatures, but the writer believes that in the case of the Himalayan pine the low temperature was damaging primarily because it created conditions favorable to the entrance of fungi.

Prof. H. H. York, pathologist on the Arboretum staff, delivered a lecture at the Arboretum in February, 1936, on the subject of winter injury (Arboretum Bulletin Vol. I, No. 3). He emphasized the point that winter injury was not the sole cause of the death of these pines, and referred to a study of the fungi associated with the cankers which was being made by the writer.

The fungus which was found to be associated consistently with cankers on the pines was *Sphaeropsis malorum*, which is well known as the cause of a serious fruit rot, canker, and leaf spot of apple. Cultures of this fungus were obtained from the diseased trees, and inoculations were made from them on species of two, three and five needle pines and also upon young apple trees. The two and three needle pines, or "hard" pines, which were inoculated did not show signs of infection, but several of the three year old white pines were killed and a resinous canker formed on others. One of the apple trees was completely killed within three months by the canker resulting from the inoculation. These inoculations were made in small wounds produced by scraping the bark of the tree with a needle.

A study was made of the annual rings of growth in polished sections of wood taken from dead Himalayan pines. Old cankers which had subsequently callused over were noted, and their year of origin was determined by counting the rings. When these data were compared with weather records it was found that the cankers

originated in winters of unusually low temperatures. Apparently they were the result of fungus infections in cracks or lesions in the bark caused by low temperatures.

The Himalayan pine should not be considered to be unreliably hardy in this latitude. The writer observed several mature specimens in excellent health at Rochester, N. Y., during the summer of 1936. Given favorable conditions of soil and exposure, and with reasonable care taken to remove any cankers that may appear, this species of pine should continue to be a valuable ornamental subject.

Sphaeropsis malorum should not be regarded as a serious primary parasite of Himalayan pine, but rather as a wound parasite which may become very serious in weakened trees. Local abundance of apple trees, which are the primary host of this organism, might account for its prevalence in this area.

Botanical Department
University of Pennsylvania.

PLANT PATHOLOGICAL
LABORATORY



THE HERBARIUM OF THE MORRIS ARBORETUM

—BY—

JOHN MILTON FOGG, JR.

Taxonomist, Morris Arboretum

THE visitor who penetrates to the second floor of the Administration Building of the Morris Arboretum will find there a large room lined with tall metal cases. A glance into one of these cases will reveal pigeon holes filled with large sheets of white paper to which are affixed dried and pressed specimens of plants. In a word, the visitor has entered the Herbarium.

There are some to whom a collection of dead and flattened plants seems nothing more than just so many mummies. They will see here only the lifeless remains of a world of vegetation and will turn away with indifference, if not contempt, from what they consider to be merely a botanical graveyard.

To the botanist, however, such a collection serves as a fascinating and indispensable aid in his studies of plant relationships and plant distribution. The well organized herbarium represents a veritable treasury of fact and information. Not only is each specimen accompanied by a label giving data of great interest and value, but thanks to modern methods of collecting and pressing plants, the specimens themselves are remarkably lifelike.

Probably everyone has had the experience of attempting to press and dry some flower that interested him—perhaps a rose, a violet or a spray of forget-me-not. Discouraged by the dismal results invariably procured from placing a specimen between sheets of note paper or the pages of a book, the disillusioned collector has doubtless forsworn all further experiments of this nature and has concluded that of all forlorn and unrealistic objects none can surpass a dried plant!

Today, however, the botanist who wishes to preserve plants for study utilizes a vastly superior technique. By using large sheets of absorptive paper, corrugated ventilators and cotton pads, aided frequently by artificial heat to hasten drying, it is possible to prepare specimens which have lost little, if any, of their original color and which retain to a high degree the character and appearance of the living plant. Space will not permit even the mention of the various improved and refined methods which enable us to convert a twig with a spray of flowers into permanent form with no essential sacrifice of its inherent aspect.

Surrounded by a collection such as this the student finds himself in a kind of two-dimensional botanical garden where for twelve months of the year, regardless of rain or drought, snow or ice, he may study the flora of any part of the world and compare the characters of closely related species with a view to determining their identities and affinities. In this way alone can the specimens collected by expeditions to remote places be critically and leisurely examined and species new to science detected. Thus, and thus only, can the botanist of today study the plants which grew in a given area a generation or a century ago—an area in which man or nature has frequently destroyed or profoundly modified the original flora.

The material in the cases at Chestnut Hill represents chiefly specimens of woody plants (trees and shrubs); the only herbaceous forms included are those which have a definite place as ornamentals in cultivation, such as foxgloves, bell-flowers, phloxes, asters and the like. In this way duplication with the main herbarium in the Department of Botany is avoided.

The ligneous plants in the Arboretum Herbarium have originated from two sources. First, there are the specimens made from trees and shrubs growing in the grounds of the Morris Arboretum or in other arboreta throughout the world. Then, there is that larger series representing the native woody floras of the various continents. This arrangement affords, among other advantages, an opportunity for comparing the development of a given species in cultivation with its behavior under natural conditions.

Every shrub and tree found in the Arboretum is represented in the herbarium by at least three specimens; one sheet, collected during the dormant season, shows

the all-important winter buds and leaf scars; a second collection, made usually at time of blooming, displays the flowers; a third or summer specimen exhibits the foliage and often the fruit and seed as well, although to secure the latter two stages a fourth collection is often necessary. The purpose of such a series is, of course, to demonstrate seasonal variation within each species as well as to supply a representative cross section of the complete life-history.

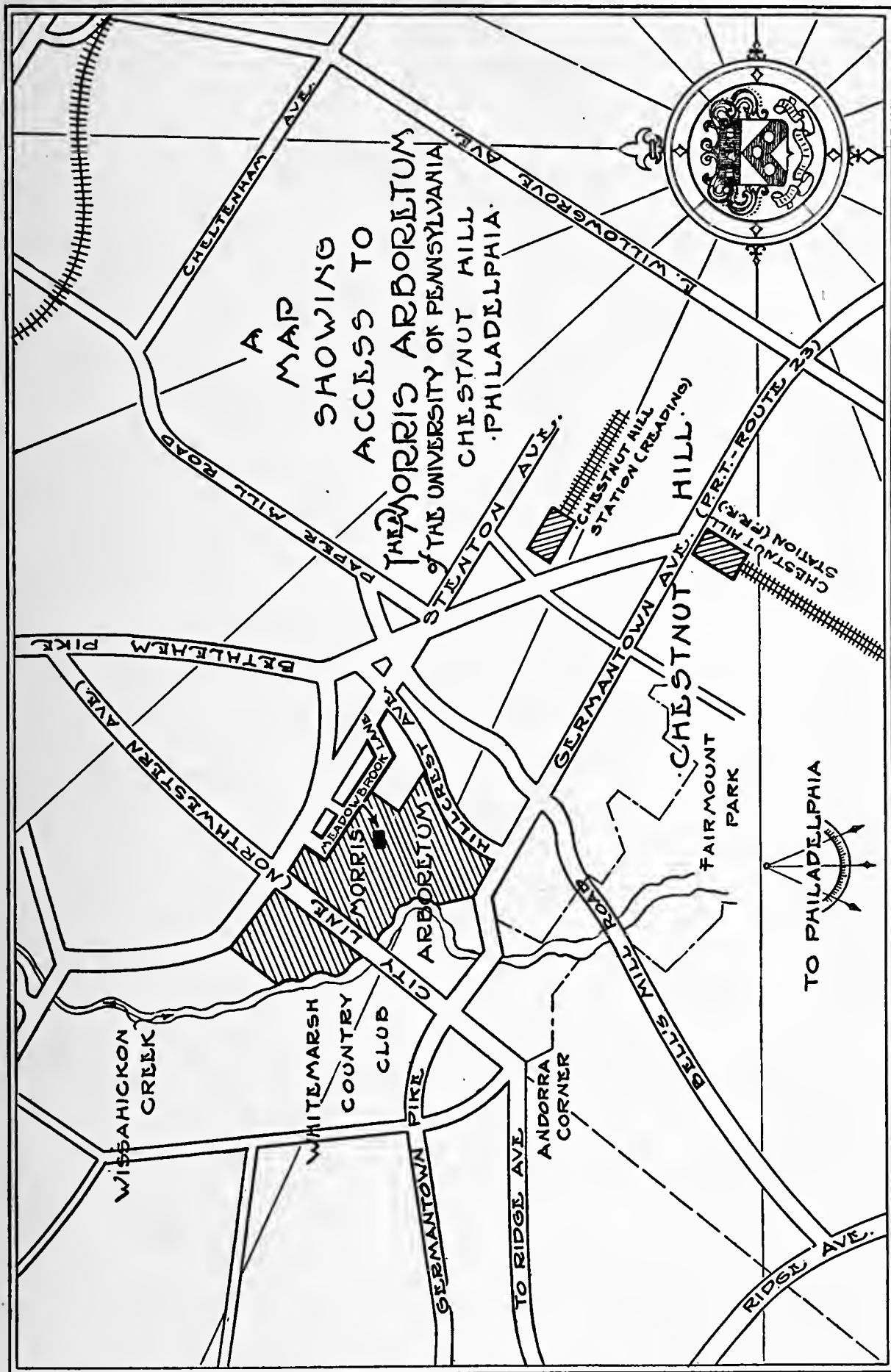
The great bulk of the material in the herbarium, however, has been collected from natural habitats in various parts of the world. This series is naturally strongest in plants from eastern North America, but every continent is represented. Eastern Asia has long been one of the important sources of cultivated plants. This is abundantly shown by the trees found growing in the Arboretum, and the herbarium is correspondingly rich in material from this part of the world. Among the most important series of dried plants acquired for the herbarium were the collection of R. R. Stewart from Kashmir (numbering over 1200 sheets) and a set of nearly 3000 specimens collected by J. F. Rock on his last expedition to China. As neither of these two exsiccatae is represented in any other institution in or near Philadelphia, the function of the Arboretum as a center for the study of Asiatic plants is obvious.

During the three and a half years that this herbarium has been in existence the number of plants has been increased by purchase, by exchange and by the field activities of the members of its staff until the collection now includes approximately 17,000 sheets. And yet this must be regarded as merely a good beginning. In order adequately to fulfill its avowed function a working collection should contain for each individual species sufficient specimens to demonstrate its natural range of distribution. Not until the student has before him such a series can he understand fully the significance of local variations, not until then can reliable range maps, showing the natural occurrence of each tree and shrub, be compiled. The ideal situation, requiring perhaps many years for its realization, would be to have for every woody plant—at least in the United States—a specimen from every county in which it grows. If then, in addition to the specimen itself, the accompanying label might convey such information as the exact locality and date of its collection, the type of soil in which it grew, the nature of its surrounding vegetation and many another pertinent and often ephemeral fact, we should in truth come to look upon the modern herbarium as an inexhaustible storehouse wherein are contained the answers to a multitude of questions.

Botanical Department, University of Pennsylvania

CORRECTION

In Vol. I, No. 6, page 77, second line from the bottom of the page
Tsuga cuspidata nana should be *Taxus cuspidata nana*.







ARBORETUM BULLETIN
OF THE
ASSOCIATES

JULY, 1937

THE
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OF THE
UNIVERSITY OF PENNSYLVANIA

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THE
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Swiss Stone Pine
Pinus Cembra L.

The Swiss Stone Pine illustrated in this number is a tree characteristic of the Alpine region of Central Europe, but its range extends to the northeastern part of Russia and Northern Asia.

This handsome, hardy species, reaching a height of from 75 to 120 feet, has a narrowly pyramidal top that may even become strikingly columnar (var. *columnaris* Beissn).

The straight, dark green leaves, borne in fascicles of five, have a serrulate margin. The cones are short-stalked, ovoid, light brown, from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches long, and bear large, edible seeds about $\frac{1}{2}$ inch long.

RODNEY H. TRUE

Photograph by
GUSTAVE LIEBSCHER

FLOWERING CRAB-APPLES*

—BY—

DR. GLEN P. VAN ESELTINE

New York State Agricultural Experiment Station, Geneva, New York

LOVERS OF ornamental trees are appreciating more and more the various qualities found in the flowering crab-apples. Hardy in the climate of the northeastern states, with colors ranging from deep or purplish red through pinks to white, and varying in stature from trees 50 feet high to shrubs 8 feet high, displaying gorgeous fall foliage and fruits, they seem to meet all demands.

Crab-apples may be grown from seed, but are usually worthless, and only a few chance crosses have given excellent forms. The creation of definitely planned hybrids is being studied at the Arnold Arboretum and at the New York State Agricultural Experiment Station. This is done when the young bud is almost ready to open. The petals and stamens are cut away, leaving the stigmas. In the more difficult crosses, the anthers are removed from the filament instead. The flowers so treated are covered by paper bags to prevent pollination before the desired pollen is applied either by brush or by finger tip. The flowers are crossed now, bagged again, and kept so until the fruit has set. The bags are then replaced by netting sacks to prevent the fruit from falling to the ground or being eaten by birds. The seeds obtained are placed in a wire screen and buried in the soil over winter. Early in the following spring, the seeds are sown in flats and the seedlings, as they come up, are set in paper pots for transplanting to the nursery. They finally reach the seedling orchard for observation. The large majority of them are thrown out as undesirable. The plants kept are budded onto field-grown seedlings. Propagation by bench grafting is used, but a whip graft is more often used.

In both budding and grafting the stock should be a congenial type. When uncongenial, the scion may outgrow the stock, or the stock may outgrow the scion. Ordinary apple stocks are not suited to all crab-apples, a short-lived tree resulting. On the basis of present knowledge, it seems evident that the prairie crab (*Malus ioensis*), or the wild sweet crab (*Malus coronaria*), form the best stocks for American types, and the French crab or Siberian or Tea Crabs for Asiatic types.

The culture of crab-apples is easy. They respond to plenty of sunlight, good drainage, sufficient humus to hold the soil moisture, and to fertilizers high in nitrogen, such as ammonium or nitrate salts. Pruning for shape only is the rule. Young plants of crabs and some others may need to be cut back heavily to force a shrubby growth. Hedges are pruned in June after the flowering period, and again in July. Later pruning would destroy the bloom for the following year.

* Summary of a lecture given at the Morris Arboretum of the University of Pennsylvania on March 13, 1937.

Diseases and pests are not numerous and can be controlled. Apple scab and "cedar" or Juniper rusts are the diseases, and aphids the chief pest.

The cedar rust and the quince rust are sometimes severe in this region. The cedar rust spreads from cedar to apple and back again. It forms spots on the leaves of the apple and may defoliate it. The fruit is also often affected. On the cedar tree the fungus forms "cedar apples" and spore-bearing "horns" project from the apple in all directions. When the horns no longer become turgid when moist, the danger of infection is past. In the "quince rust" the quince is the alternate host. Both release their spores in wet weather. Hence, spraying for this disease is done immediately preceding a rain.

The treatment consists of sprays carrying colloidal sulphur. The Arnold Arboretum recommends the following spray solution for "perfect control" of the Juniper rust:

To 5 or 6 pounds of colloidal sulphur made by the Mechling Company, Camden, New Jersey, sold under the trade name of "Linco," 3 pounds of "S.S.3" to 100 gallons of water. S.S.3 is a commercial "spreader" obtainable at any store selling spray materials. Spray first when the young leaves become visible and follow with four or five sprays at 6- to 10-day intervals.

The pathologists of the New York State Agricultural Experiment Station at Geneva recommend for amateur use as alternatives to "Linco," either "Kolofog" produced by the Niagara Sprayer & Chemical Company, of Middleport, New York, or the Dry Flotation Sulphur, made at the Camden Coke Plant, Camden, New Jersey. Skimmed milk will serve as a spreader when such is needed. The quantity of spreader is determined by experience. The spray must cover every bit of growing tissue, but not run off.

Nicotine sulphate with hydrated lime to release the nicotine is used for control of aphids: 1 pint of sulphate and 3 to 4 pounds of hydrated lime to 100 gallons of water.

Lead acetate, 3 pounds to 100 gallons of water, will control chewing insects.

Concerning ornamental values, crabs may be massed or grown as specimens. As to blooming succession, the Manchurian crab-apple (*Malus baccata mandshurica*) blooms first, and is also the tallest kind, sometimes reaching a height of 50 feet. A week later the Toringo (*Malus Sieboldii*) and Sargent (*Malus Sargentii*) crabs flower. Sargent's crab, the smallest of the Asiatic types, seldom exceeds 8 feet in height, with a spread of 15 or 16 feet. Both the Manchurian and the Sargent crabs are excellent in flower and in fruit.

Scheidecker's crab, a hybrid between *Malus floribunda*, the Japanese flowering crab, and *Malus prunifolia*, the pear-leaf crab, reaches a height of 18 to 25 feet.

The Chinese flowering crab, *Malus spectabilis*, and its variety *Riversii* (sometimes called *rosea* f. *plena*) are ordinarily rather erect types.

Reference was made to the hybridization work being carried on at the New York State Agriculture Experiment Station at Geneva, New York, where some outstanding types have appeared. A cross between *Malus zumi* (*baccata* *mandshurica* x *Sieboldii*) and *Malus niedzwetzkyana* (the red-vein crab) is specially promising, and further developments will be watched with much interest.

Some of the American species have interesting form with horizontal branching, as the Missouri crab (*Malus bracteata*) a close ally of the Prairie crab (*Malus ioensis*); Bechtel's crab is a completely double-flowered form of the latter.

The open-headed type of the American crab is illustrated in the Hall crab (*Malus Halliana*). The flowers differ considerably in size and color.

Several sorts were briefly characterized:

The Tea crab, resembling a cherry more than a crab in its fan-like aspect; Parkman's crab, a semi-double variety of *Malus Halliana*, with long, drooping pedicels, and low-growing habit; *Malus floribunda*, the Japanese flowering crab, one of the oldest and most popular types; the Carmine crab (*Malus atrosanguinea*)—(*Malus Sieboldii* x *Malus Halliana*)—retaining the deep color of the young flowers, are prominent types.

The wild American crab (*Malus coronaria*) is a fragrant, thorny, small tree with gorgeous blooms. The American types bloom last of all.

The value of the fruits for ornamental purposes, as well as an attraction for birds, was discussed. The Japanese flowering crab and the cut-leaf crab (*Malus toringoides*) were given special mention. A list of the twelve best crabs follows:

1. *Malus Arnoldiana* (*floribunda* x *baccata*).
2. *Malus atrosanguinea* (*Sieboldii* x *Halliana*).
3. *Malus coronaria* and form *Charlottae* (American).
4. *Malus floribunda* (Asiatic).
5. *Malus Halliana* *Parkmanii* (Asiatic).
6. *Malus ioensis plena* "Bechtel's crab" (American).
7. *Malus hupehensis* and form *rosea* (Asiatic).
8. *Malus purpurea Eleyi* (*Niedzwetzkyana* x *atrosanguinea*).
9. *Malus Sargentii* (Asiatic).
10. *Malus Sieboldii* "Toringo" (Asiatic).
11. *Malus spectabilis* and var. *Riversii* and var. *albi-plena* (Asiatic).
12. *Malus toringoides*, "cut-leaf" (Asiatic).

Summary by RODNEY H. TRUE

THE ORDER OF BLOOM OF WOODY TREES AND SHRUBS

—BY—

DR. DONALD WYMAN

Arnold Arboretum, Jamaica Plain, Mass.

THE SEQUENCE of the order of bloom of trees and shrubs is a very important phenomenon to the practical gardener, for with an accurate knowledge of it he can have woody trees and shrubs in bloom a greater part of the year. One of the most important things in a study of the sequence of bloom is the association of plants which are in bloom at the same time and so can be used together in the landscape scheme. The actual time of bloom is not nearly as important as this association, since in some years the season may be retarded or advanced, depending on the climatic conditions. The association of plants which bloom together will always be the same no matter whether the season is retarded or advanced. The time of bloom of the following notes has been taken in Boston, Massachusetts, and may be at least two weeks earlier for the Philadelphia area.

The first woody plant of the year to bloom is *Hamamelis vernalis* which often opens its flowers on January first even as far north as the Arnold Arboretum. These witch-hazels are a most interesting group, since it is they which "tie in" the full year of bloom, for *H. virginiana* is the last plant in the fall to bloom, and *H. vernalis* is the first plant of the year to bloom. This is immediately followed by *H. japonica* and *H. mollis*, both of which are excellent for their early flower. They come sometime in February or March, depending on the season.

In early April several shrubs are of interest. The alders, with their catkins, are familiar to everyone; *Cornus mas* is usually a brilliant yellow for a week or more; the February daphne with its small but effective purple flowers is also of interest, particularly valued in the landscape because in late summer it will have bright red berries. *Erica carnea*, the spring heath, of which there is a white-flowered form available, also blooms in early April, and if protected will make a good display. *Lonicera fragrantissima* needs no introduction, nor does *Populus tremuloides* nor *Salix discolor*, the common pussy willow. All these plants normally flower in early April.

In mid-April we can expect the small bright red flowers of *Acer rubrum*, the rosy-purple flowers of *Rhododendron mucronulatum*, which although it is a true rho-

* Summary of a lecture given at the Morris Arboretum on April 10, 1937.

dodendron, is commonly thought of as an azalea, and as such is the first azalea of the year to bloom. Although *Benzoin aestivale*, *Corylopsis* species, and *Forsythia* species also bloom at this time, the azalea is most outstanding, because the color of its flowers differs widely from the yellow flowers of most of these shrubs of this early period. There are a few plants like the bush-honeysuckles, Japanese barberries, and *Prinsepia sinensis*, which by this time are starting to show their leaves and are among the first shrubs to become green in the spring. This is an important feature, for often we may wish to enjoy our gardens at a definite period early in the year, and one or two of these shrubs showing the strong green color will be greatly valued if planted in the right location.

By late April the small greenish yellow flowers of *Acer platanoides* are out; the larches are beginning to show green; *Magnolia kobus* and *M. stellata* are in full bloom; and the delicate nodding clusters of *Pieris floribunda* and *P. japonica* can be seen in many places enhancing a garden nook. At this time, too, the first of the Japanese cherries begin to bloom, particularly the single-flowered types such as *Prunus subhirtella* and its weeping variety, *P. subhirtella pendula*, the Sargent cherry, *P. Sargentii*, and the Yoshino cherry, *P. yedoensis*.

By early May we are definitely assured that spring has come to stay, for there are many plants which are in full bloom by that time. A few of these would be the shadblows; *Rhododendron obtusum* varieties, such as *amoenum* and "Hinodegiri"; the brilliant red, pink, and white forms of the Japanese quinces, which were so valued in old-fashioned gardens, but since the advent of Japanese barberries have not been used in hedges any more because they are susceptible to fire blight, borers, and scale. Many of the blooms (*Cytisus* and *Genista*) are becoming conspicuous at this time for their yellow flowers. It is interesting to know that there are white-flowered forms available and even a purple-flowered form. Other magnolias in full bloom would be *Magnolia denudata* and the many varieties of the saucer magnolia, *M. Soulangeana*. The yellow flowered *Mahonia Aquifolium* is at its height at this period and certain other cherries, particularly some of the double-flowered forms. The old-fashioned *Ribes odoratum* is a mass of golden-yellow, and its very fragrant flowers are admired by everyone, particularly when it is planted in combination with such white-flowering plants as the *Spiraea prunifolia plena* and *S. Thunbergi*, which are also in bloom in early May.

Just a very few of the plants in bloom in mid-May would be *Alyssum gemonense* and *A. saxatile*, *Caragana arborescens*, with its yellow pea-like flowers, the redbud, and the native flowering dogwood, which together make an excellent

flowering combination. The outstanding display of this period might be the azaleas, particularly *Rhododendron Schlippenbachii*, *R. Vaseyi*, *R. yedoense poukhanense*, and *R. obtusum Kaempferi*, the last being the most brilliant flowering shrub which the Arnold Arboretum has had the opportunity of introducing from Japan.

The peculiar *Fothergilla* with its thimble-like flowers is conspicuous at this period, as is also the dainty silverbell, and the last of the saucer magnolias to bloom, the variety *M. Soulangeana Lennei*. The crab-apples almost always give a splendid display of bloom, and it is impossible in this short space to mention them all. However, some of the single-flowered forms such as *Malus arnoldiana*, *M. atrosanguinea*, *M. baccata*, *M. floribunda*, *M. micromalus*, *M. purpurea*, and *M. Sargentii* are all at their best together with double-flowering forms such as *M. Halliana Parkmanii*, *M. Scheideckeri*, and others. Also some of the larger of the double-flowering Japanese cherries would be still in bloom by mid-May such as "Fugenzo," "Shirotae," and "Kwanzen," all of which are good and very popular. Although normally the lilacs do not bloom until late May, nevertheless the first of the lilacs bloom in mid-May, and these would be varieties of *Syringa hyacinthiflora* and *S. oblata*. The very fragrant *Viburnum Carlesii* is also at its best in mid-May. The first of the *Weigelas* (*Fleur de Mai*) also begin to bloom at approximately this time.

By late May the horse chestnuts, the hybrid azaleas, and the many species and varieties of lilacs are all at their best. The hawthorns are beginning to bloom, many of the *Deutzias* are in full flower, and often a *Laburnum* can be seen somewhere to thrill many with its long golden clusters of bright yellow flowers. The bush-honeysuckles are in full bloom, the native crab-apples such as *Malus coronaria*, and *M. ionensis plena* are at their best. Usually a *Rhododendron* such as the hybrid "Boule de Neige" is in flower at this period, for this is one of the first hybrids to appear in the spring. Certain roses, such as *Rosa hugonis* and *R. primula*, open their yellow flowers at the same time as these shrubs of late May. *Viburnum tomentosum plicatum* and the wisterias should not be forgotten, since they too supply most interesting flowers during late May.

In early June the hawthorns begin to flower, the fringe-tree is outstanding. *Rhododendron calendulaceum* with its brilliant orange flowers is of interest for at least two full weeks. The many hybrid rhododendrons are also in bloom during early June, and there are at least fifteen varieties of these which are perfectly hardy as far north as the Arnold Arboretum. Since June is the month of roses, we know that certain shrubs like *Rosa blanda*, *R. virginiana*, and *R. multiflora* are expected

to bloom in early June, and the sequence of roses will be carried on later with the many hybrid "teas" and "perpetuals."

By mid-June some of the clematis start to bloom, and the mountain laurel can be expected to give joy everywhere it is seen.

In late June the sweet-scented *Rhododendron arborescens* is in flower, together with such outstanding plants as *Tripterygium Regelii* and *Rhododendron maximum*. It is interesting to note that many of the bush-honeysuckles will have fruit on at this period that is just beginning to color, and so they too have their value in this landscape scheme.

During July many of the clematis clan will flower, the lindens will interest many with their sweet-scented blossoms. *Campsis radicans* will be outstanding everywhere with its large, scarlet trumpet-like flowers. The heathers too will be in full bloom, as will *Koelreuteria paniculata*, *Lonicera sempervirens*, *Rosa setigera*, the *Buddleias*, and the sweet-scented summersweet, *Clethra alnifolia*.

By August comparatively few shrubs will flower, but there will always be that strange *Albizia julibrissin rosea* with its silk-like flower clusters, the large flowering *Hydrangea* "Pee Gee," the *Vitex*. It should always be kept in mind that many of the shrubs will have fruits which are beginning to change color at this time and so can be used for this purpose.

In September *Clematis paniculata* and *Polygonum Aubertii* can usually be depended upon for excellent flower displays, and the *Gordonia altamaha* does not even begin to bloom until about the middle part of September and will continue, at least in the Arnold Arboretum, until frost eventually kills the flowers.

The last plant of all the year to bloom is the native *Hamamelis virginiana*.



THE JAPANESE BEETLE

—BY—

PHILIP P. CALVERT

Professor of Zoology, University of Pennsylvania.

THE JAPANESE BEETLE, *Popillia japonica*, is one-half inch long, shining green at head and tail, brown with shining green reflections on the middle portion (wing-

covers or elytra) of its body above, while it is of a duller, darker, but still shining green below. On the body's surface, especially underneath, are many white hairs, often in rows or tufts, and so arranged as to give the appearance of five white spots on each side just below each brown elytron, and a pair on the upper surface near the hind end. These white markings are characteristic. While males are often smaller than the females, one can not always rely on size to distinguish them. To be sure of the sex, one must look at the first pair of legs with a low power lens; if the two claws at the tip of each leg are of nearly equal thickness the individual is a female, if one claw is markedly thicker than the other, we have a male. In addition, the last long joint (tibia) of each male first leg has a pointed projection at its tip, while in the female the corresponding part is rounded.

These beetles are to be seen around Philadelphia from mid-June to October, although they are most numerous in late July and early August. On warm bright days they fly actively and feed voraciously, not less than 260 kinds of plants having been observed to serve as food at one time or another.

Beginning in July the females burrow in the ground to a depth of 2 to 4 inches, where they lay a few elliptical, later spherical, eggs, one-sixteenth of an inch in diameter. Ascending to the air, they resume feeding and later burrow again to deposit additional eggs. This alternate eating and ovipositing may extend over many days until the 40 to 60 eggs, to be found in the ovaries of a single female, have been placed in the soil. Each egg requires about two weeks to hatch, when it yields a white grub or larva, having a cylindrical body curved or bent upon itself, when not crawling. The grub feeds upon the roots of plants, and increases in length from one-eighth of an inch to one-inch in length during a period of approximately ten months. This grub, or larval, existence is divided by two moults, or sheddings of the outer covering of the body, into three periods (instars), the first of which usually occupies about three weeks, the second about three weeks and the third eight-and-one-half months. This third larval period or instar is consequently the one in which the winter is passed, and during it the grub is often inactive and may not eat until spring is well established. However, even under natural conditions, the first or the second instar may be so prolonged that cold weather overtakes the grub in that period, with the result that the other one or two instars may not follow until spring. Experimentally also, as has been shown by Dr. Daniel Ludwig, it is possible to modify the lengths of these instars by different kinds of food and by temperature, so that, as he says, "the life history at 20 degrees centigrade is different from that at 25."

In May or in June larval life normally comes to an end when another moult marks the change to the pupa, a non-feeding, quiescent condition, in which the wings, legs and feelers of the future adult first appear on the exterior of the body. Finally, after 8 to 20 days, the last moult, casting away the pupal "skin," produces the adult beetle which shortly ascends to the surface of the ground. Thus a "complete transformation" or "complete metamorphosis" is accomplished, whose distinguishing feature is the non-feeding, non-growing, non-reproducing pupal stage, inserted between the feeding, growing but non-reproducing grub and the feeding, non-growing but reproducing adult beetle. Butterflies, moths, wasps, bees, ants, flies are other insects which undergo a "complete" transformation. In them, as in the beetles, we see another characteristic of "complete" metamorphosis: the body of the adult is shorter than that of its own preceding full-grown caterpillar, grub or maggot. On the other hand, such insects as grasshoppers, crickets, dragonflies and bugs, which have no pupal stage and therefore show an "incomplete" transformation, progressively increase in body length throughout their individual lives. The shrinkage in length which characterizes the adult insects with complete metamorphosis is doubtless correlated with the more thoroughgoing changes in their internal organs which take place during late larval and pupal periods, as contrasted with the slighter alterations in the viscera experienced by the other group.

The contrast between the larva of the Japanese beetle and the beetle into which it develops is very striking: the former in the soil, in darkness, crawling slowly from root to root, the latter in the air, in light, flying vigorously from leaf to leaf, to flower, to fruit. Not all beetles show such a divergence in their successive abodes. The (Colorado) potato beetle, so often miscalled potato *bug*, lives both as larva and as adult on the foliage of the potato family; the change in habits and surroundings is not as great here as in the Japanese beetle, but both have a pupal stage spent in the ground and it is as an adult, in the ground, that the potato beetle passes the winter. The potato beetle achieves two generations a year, while the Japanese beetle has but one in that time.

The preeminence of the Japanese beetle as a destructive insect is due to its wide range of food plants in the adult stage, already mentioned. Protect the plants of the potato family and a few others in a given area, and the potato beetles and their grubs die of starvation because they are unable to eat other kinds of food. Protect plants from Japanese beetles and these insects readily adjust themselves to members of widely different families of plants. Within the vegetable kingdom, the Japanese beetle is largely omnivorous and as such possesses all the advantages of the unspecialized in the struggle for existence.

As its common name indicates, the Japanese beetle is a native of the Land of the Rising Sun and is believed to have been first found in the United States in 1916, near Riverton, New Jersey. It presumably came in the grub stage in soil accompanying imported plants. Its spread between 1916 and 1923 was steady but in the latter year, says Dr. Henry Fox, "there ensued a remarkable acceleration of the rate of spread which can only be explained by assuming that some factor of dispersal, not previously operative, had come into play. This factor I find in the fact that in 1922 for the first time the beetles invaded the great freight and shipping centers in the cities of Camden and Philadelphia. As a result of their becoming accidentally imprisoned in freight cars, shipholds and other closed conveyances, beetles would be carried away from these centers with no chance to escape until their conveyance reached its destination. . . . Moreover there has come about, within the past few years [this was written in 1927], in the heavily infested area, an increased use of motor vehicles to transport farm produce to distant points accessible to this form of traffic. There is, accordingly, good ground for assuming that the sudden leap in the beetle's range which characterized the season of 1923 and which has been a marked feature of its subsequent spread, is not to be attributed to any sudden increase in the innate dispersive capacity of the insect itself, but to the fact that, as a result of these two conditions, neither operative on an extensive scale previous to 1922, its artificial dissemination through these means became factors of major importance in extending the insect's apparent range."

The natural spread of the beetle by its own efforts was estimated by Dr. Fox, in 1932, to have occurred at a rate of 6 miles per year to the east of Riverton, the Atlantic Ocean having been reached in 1926, southward at 4.5 miles per year with the attainment in New Jersey of Delaware Bay in 1930, northward and westward at 3 to 4 miles per year. He adds: "It is of interest to contrast the distances to which, from 1918 to 1931, the Japanese beetle has been carried through its own efforts with those to which it has been conveyed through artificial agencies. The former range from 35 to 60 miles, whereas the distances in miles from the original center of the distribution area to certain of the more distant points at which Japanese beetle colonies are recorded are approximately as follows: Boston, Massachusetts, 270; Buffalo, New York, 290; Columbus, Ohio, 430; Richmond, Virginia, 250; Norfolk, Virginia, 250; Charleston, South Carolina, 575." Still more recently, the beetle has been noted at St. Louis, Missouri, 850 miles from Riverton. Looking into the future and comparing the climatic conditions in Japan with those in the United States, Messrs. Hadley and Hawley, in their general survey of 1934, think that

"the Japanese beetle will be able to develop in most of the states east of western Kansas. In northern New England and in the interior north of Illinois, Missouri and Nebraska, the winter temperatures may be low enough to prove fatal to larvae especially in the absence of snow."

This naturally brings us to consider the question frequently asked as to the effect of recent cold winters, 1933-35, in the Philadelphia area on the grubs of this beetle. This has also been dealt with by Dr. Fox in a special paper. It appears that about 15 degrees Fahrenheit is the lowest temperature which the grubs can withstand under natural conditions. Such degrees of cold have been recorded in the soil at Minneapolis to a depth of about 12 inches, well below that at which Japanese beetle grubs usually occur. Such low temperatures only exist when there is no snow lying on the ground. At temperatures lower than 50° F. the grubs are inactive and in most years, in the vicinity of Philadelphia, they rarely are more than five inches below the surface when this soil temperature is reached. In the cold spell of February, 1934, the presence of snow prevented a drop of soil temperature to anything near 15° F. and the existing evidence is that the grubs did not burrow more deeply in that winter than in other warmer years. The conclusion is, therefore, drawn that only when a cold period is sufficiently long, and is unaccompanied by a snow cover, does the soil become cold enough to cause the death of the grubs. Deeper burrowing by the latter does not occur.

It has already been mentioned that the adult Japanese beetle has been observed to feed upon approximately 260 different kinds of plants, "but it does not relish all of these to the same extent." Other plants are rarely or never attacked by this beetle. In the endeavor to determine what causes the preference on the part of the insect, an investigation of the relation of sugar content and odor of clarified extracts of plants to their susceptibility to attack was made by Messrs. Metzger, van der Meulen and Mell. A study of ninety-seven plants led them to the conclusion that those having 15 or more milligrams of reducing sugar (dextrose) per gram of their own weight and a fruity odor to their clarified extracts are favored by the Japanese beetle, while those with a smaller proportion of dextrose and lacking a fruit-like odor to their extracts are not attacked, or but lightly attacked. The nature of the substances causing the fruity odor was not determined. These results, however, do not apply to certain plants which grow in the shade, or whose leaves are hard, waxy, or hairy, so that the beetles cannot feed upon them readily.

From these and other observations it is inadvisable to plant ornamental trees and

shrubs such as linden, horse-chestnut, some maples, elms and sweet cherries, which are known to be especially favored by the Japanese beetle. If already planted, they can be protected by spraying, but why plant them new when they need so much protection, unless cost in labor and materials be no deterrent?

From the wide range of food and the long active season of the Japanese beetle, it follows that foliage, flowers and fruit may be attacked in succession. Leaves and blossoms may in many cases be protected from insect attack, but it is often impossible to apply any remedy to fruit on the tree that will not interfere with its use as human food. Lime has been the favorite repellent where arsenates are out of the question, while very recently (1937) Guy and Schmidt say that derris or tetramethyl thiuram disulphide, combined with a rosin sticker, offers considerable promise. Harvested fruit, in course of transportation, has been fumigated with little or no disagreeable effects.

The subterranean grubs have also been attacked by chemical means. Arsenicals, naphthalene and paradichlorobenzene applied to soil have caused death of larvae and have been found by Lipp to prevent egg-laying for as many as 32 days under experimental conditions. The effectiveness of all chemical treatment for both adults and grubs varies with environmental conditions and the subject is too extensive to be dealt with here.

The usefulness of traps in reducing the numbers of Japanese beetles has been called in question. Metzger, writing last year, says: "No definite statement can be made regarding the effectiveness of traps in areas of heavy or even moderate infestation. After ten years' experience, these devices are more efficient in lightly infested districts. Improvements in bait have not resulted in a trap which will attract all the beetles in the immediate vicinity, nor have the improvements in the trap resulted in one which will capture all the beetles which are attracted." His latest recommendation as to the bait is that it be composed of geraniol, 20 parts, eugenol, 2 parts, and phenyl ethyl alcohol, 1 part.

The biological checks to the increase of insects are chiefly insectivorous vertebrates and insects. Certain birds and mammals have been observed to feed upon the adults and grubs of the Japanese beetle. Adults have been found in the stomachs of purple grackles and they are eaten also by the starling, cardinal, meadow lark, cat bird, English sparrow, robin, chicken, turkey and ducks, while the starling, purple grackle, crow and chicken consume the grubs. Sim conducted feeding experi-

ments on caged mammals, offering them Japanese beetle grubs with other food. He reports: "The majority of our small terrestrial mammals are more or less enthusiastic feeders upon Japanese beetle grubs, the common mole, the large short-tailed shrew, the skunk and perhaps the pine mouse are in this way the most important. Each shrew will eat from 10-20 larvae before getting enough for one meal. In an hour or less it is dinner time again."

Soon after the seriousness of the Japanese beetle plague in New Jersey was realized, entomologists of the United States Department of Agriculture began investigations, through nine years, 1920-1928, of this insect and of other species of the genus *Popillia* in the Far East. During the first four years' study in Japan, the Americans did not observe it as a serious pest, although Japanese writers have recorded it as at times doing considerable damage to soybeans. Assuming that its relative unimportance to plant cultivation in that country was largely due to insect enemies which held it in check, special attention was directed to the native parasites. As a result five species of flies were found attacking the adult *japonica* and one fly and one wasp infesting the grubs. Other flies and wasps normally attacking other species of *Popillia* will turn their attention to *japonica* on opportunity. The first five flies mentioned lay their eggs upon the adult beetle which is devoured by the maggot which penetrates it or they give birth to active maggots which, in ways still unobserved, succeed in entering and destroying the beetle. The fly responsible for parasitizing the Japanese beetle grub, as well as one from Chosen (Korea) which will attack it, lay living maggots on the soil and these seek the grubs, guided perhaps by the sense of smell, and on finding the objects of their search penetrate and feed within them. The adult female wasp burrows in the soil until she finds a beetle grub, stings it, producing paralysis of the latter, and then attaches her egg to the surface. The wasp larva after hatching remains upon the exterior of the grub feeding through a puncture made by its jaws in the grub's skin.

Up to 1928, parasitized beetles and grubs with their fly parasites, wasps and wasp cocoons, to the number of above one million-and-one-third insects, were shipped from the Far East to the Riverton laboratory. In 1934 Hadley and Hawley stated that five species of parasites, three from Japan and two from Chosen, were established in the infested area of the United States. Two of them, both wasps (*Tiphia*), are more promising than the others. Of one of these (*Tiphia popilliavora*), from Japan, Brunson says that 191 colonies, each of 100 females, were liberated between 1927 and 1931. Shipments of the other wasp (*T. vernalis*), from Chosen, were con-

tinued yearly to 1933, when it was considered that "further importations are no longer necessary as several locally established colonies are now sufficiently large to supply material for colonization purposes" (Gardner). Balock states that diggings in 1933 at Overbrook, Pennsylvania, colonized by *vernalis* in 1929, indicated a parasitization of 7.4 per cent of 214 beetle grubs examined, and similar diggings at Philmont, Pennsylvania, in October, 1933, showed parasitization of 28.8 per cent over a limited area.

Still another biological method of combatting the grubs is to infect the soil with thread worms (nematodes), which, taken in with food by the grubs, destroy the latter. Methods for cultivating the thread worms for this purpose and for inoculating soil with them are being developed by Glaser and associates.

The literature on the Japanese beetle is becoming extensive and only brief indications of some recent sources of information can be given here. General information, by Hadley and Hawley, is in Circular 332 (1934) of the U. S. Department of Agriculture and by Rex in Circular 242 (1934) of the New Jersey Department of Agriculture. Ludwig's paper is in *Physiological Zoology*, volume V (1932), that by Metzger, van der Meulen and Mell in the *Journal of Agricultural Research*, volume 49 (1934). Accounts of the parasite investigations in the Far East by Clausen and associates are in Bulletin 1429 (1927) and Technical Bulletin 366 (1933) of the U. S. Department of Agriculture. Glaser's papers may be learned in Circular 265 (1936) of the N. J. Dept. of Agric. The papers by Fox, Guy and Schmidt, Lipp, Metzger, Sim, Brunson, Gardner and Balock will be found in the *Journal of Economic Entomology*, volumes 20 (1927), 25 (1932), 27-30 (1934-37). Almost all of these articles contain lists of earlier literature.



NEW MEMBERS OF THE ADVISORY BOARD OF MANAGERS

THE VACANCIES in the membership of the Advisory Board of Managers, caused by the passing of Mr. Harper and of Colonel Robert Glendinning, have been filled by the acceptance of membership by Messrs. Thomas D. M. Cardeza, Horace H. F. Jayne and Wharton Sinkler, all of Philadelphia.

MORRIS ARBORETUM FELLOWS

AMONG THE PURPOSES to be promoted by the Arboretum is the maintenance of post graduate work for students after they have finished their preliminary ground-work in school or college. This provision was carried out in August, 1933, by the appointment of five Fellows, each enjoying a stipend of \$1200 per annum. These Fellows enrolled in the Graduate School of the University, and pursued work looking to the taking of higher degrees in botanical science.

Since in training and in sending these young men and young women to their several subsequent positions, the University and the Arboretum have rendered a genuine service in advancing plant science and its useful applications, it has seemed worth while to give a brief statement of their activities.

LEWIS E. ANDERSON

Born in Batesville, Mississippi, he was appointed to a Morris Arboretum Fellowship in August, 1933, being reappointed for the following school year of 1934-35. He took his Ph.D. degree in June, 1936, the subject of his dissertation being "Mitochondria in the Life Cycle of Certain Higher Plants." He assisted in the teaching work at the University. During the following school year, now closing, Anderson has been a member of the botanical staff of Duke University, with which institution he will continue during the coming year.

RUTH L. BEALL

Born at West River, Maryland, and a graduate of Goucher College, Miss Beall was appointed to a Morris Arboretum Fellowship in August, 1933, a position she continued to hold until February, 1936, when she took her Ph.D. at the University of Pennsylvania. She was appointed to the botanical staff of the University of Georgia, a position she still holds. She teaches classes in plant physiology. Her dissertation dealt with the "Absorption of Electrolytes by Seedlings."

THOMAS W. CHILDS

Born at Rockwell City, Iowa, Mr. Childs was also appointed in August, 1933, held his Fellowship until June, 1936, when he took his Ph.D. degree at the University of Pennsylvania. His major subject was in Forest Pathology, his dissertation dealing with the "Variability of *Polyporus Schweinitzii* in Culture." He was im-

mediately appointed to the U. S. Bureau of Plant Industry of the Division of Forest Pathology, at Portland, Oregon, a position he still holds.

ESTHER L. LARSEN

Miss Larsen, born at Minot City, North Dakota, was appointed in 1933, and reappointed for the year 1934-35. She has taken her preliminary examination for the Ph.D. degree at the University of Pennsylvania. Her special subject of study is "A Study of the Tidal Marsh and Beach Flora for East Central Delaware." She has married Dr. K. D. Doak, of the Division of Forest Pathology, in the U. S. Department of Agriculture, now stationed with the Allegheny Forest Experiment Station, co-operating with the University of Pennsylvania.

WILLIAM E. MCQUILKIN

Mr. McQuilkin was born at David City, Nebraska and accepted a Morris Arboretum Fellowship in the fall of 1933. After a year he became a teaching assistant in the Botany Department at the University, a position held until he received his Ph.D. degree in June, 1936. His dissertation dealt with the "Root Development of Pitch Pine With Comparative Observations on the Short Leaf Pine." He accepted an immediate appointment with the Conservation work of the national Department of Agriculture, with headquarters at Lincoln, Nebraska. He is still in the Government service, with the Appalachian Forest Experiment Station, at Asheville, North Carolina.

The record made by the Arboretum Fellows is most creditable. They have accepted significant places in the educational world or in the research personnel of Governmental agencies, where their several abilities and lines of training will continue to reflect credit on the Arboretum and on the University of Pennsylvania in the years to come.

The appointment of a Fellow for the coming school year, 1937-38, has been authorized, and Mr. F. R. Fosberg, of the Botany Department of the University of Hawaii, Honolulu, has been appointed. His botanical studies began at Pomona College, Claremont, California, under Dr. Philip A. Munz. He later worked in the herbarium of the Los Angeles Museum. In 1932, he was chosen assistant to Professor Harold St. John, of the Botany Department, University of Hawaii, at Honolulu, a position he still holds. In 1934, he was made Botanical Assistant to the Bishop Museum Expedition to the South Seas.

ARBORETUM VISITORS

THE ARBORETUM has continued to be a favorite place for visitors from Pennsylvania and neighboring states. Classes from schools and colleges come in groups. Garden clubs and various societies meet here.

The women of the University again held their May Day "Frolic" on May 8th, and again the crowning of the Queen followed a dramatic presentation of beauty and novelty. The Alumnae of the University had their annual meeting and luncheon at the Arboretum on the same day. Again, the Senior Garden Party and Class Day Exercises were held at the Arboretum on June 7th.

On Alumni Day at the University, the Arboretum was open all day, in the hope that graduates and members of the University of former years might become more fully acquainted with an institution that has growing significance to the University and to plant science.



RECENT GIFTS

Masonic Home,

Elizabethtown, Pa.

11 plants of trees and shrubs, 9 species.

U. S. Department of Agriculture,

52 plants of trees and shrubs, 26 species.

Dr. Frank M. Jones,

Wilmington, Delaware.

Cuttings of (immune) Boxwood.

Mr. Albert Nalle,

Whitemarsh, Pa.

Seeds of *Pseudolarix amabile*.

Mr. John C. Wister,

Germantown, Philadelphia, Pa.

Scions of 63 species and varieties of Lilac.

Swarthmore Arboretum,

Swarthmore, Pa.

Scions of 24 varieties of *Malus*,
Scions of 23 varieties of *Prunus*,
Suckers of 20 varieties of *Lilac*,
28 species of trees and shrubs, 42 plants, and many seedlings.

Towson Nurseries,

Towson, Maryland.

Cuttings of 30 varieties of *Rhododendrons*,
from which 232 plants have been raised.

New York Botanic Garden,

New York, N. Y.

11 plants of 6 species of shrubs.

Department of Forests and Waters,

Mont Alto, Penna.

17 species of trees, 38 plants.

Mr. Maurice Bower Saul,

Moylan, Penna.

10 specimen plants of *Pinus*, representing 5 species.

Mr. Charles Fearon,

Germantown, Philadelphia, Pa.

9 plants, trees.

The Arboretum has been greatly favored by Mrs. Eleanor Widener Dixon, of Elkins Park, who has presented to it a splendid collection of orchids.

In this collection of 233 plants, 37 genera are represented and 91 species. The list includes the following genera in rich variety:

Bulbophyllum	6 species
Caelogyne	7 species
Dendrobium	12 species
Epidendrum	7 species
Laelia	9 species
Miltonia	5 species

This has an unusual botanical interest to students of orchids, in addition to their appeal to the sense of beauty through unusual forms and color combinations. These plants have been transferred to the tropical house at the Arboretum.

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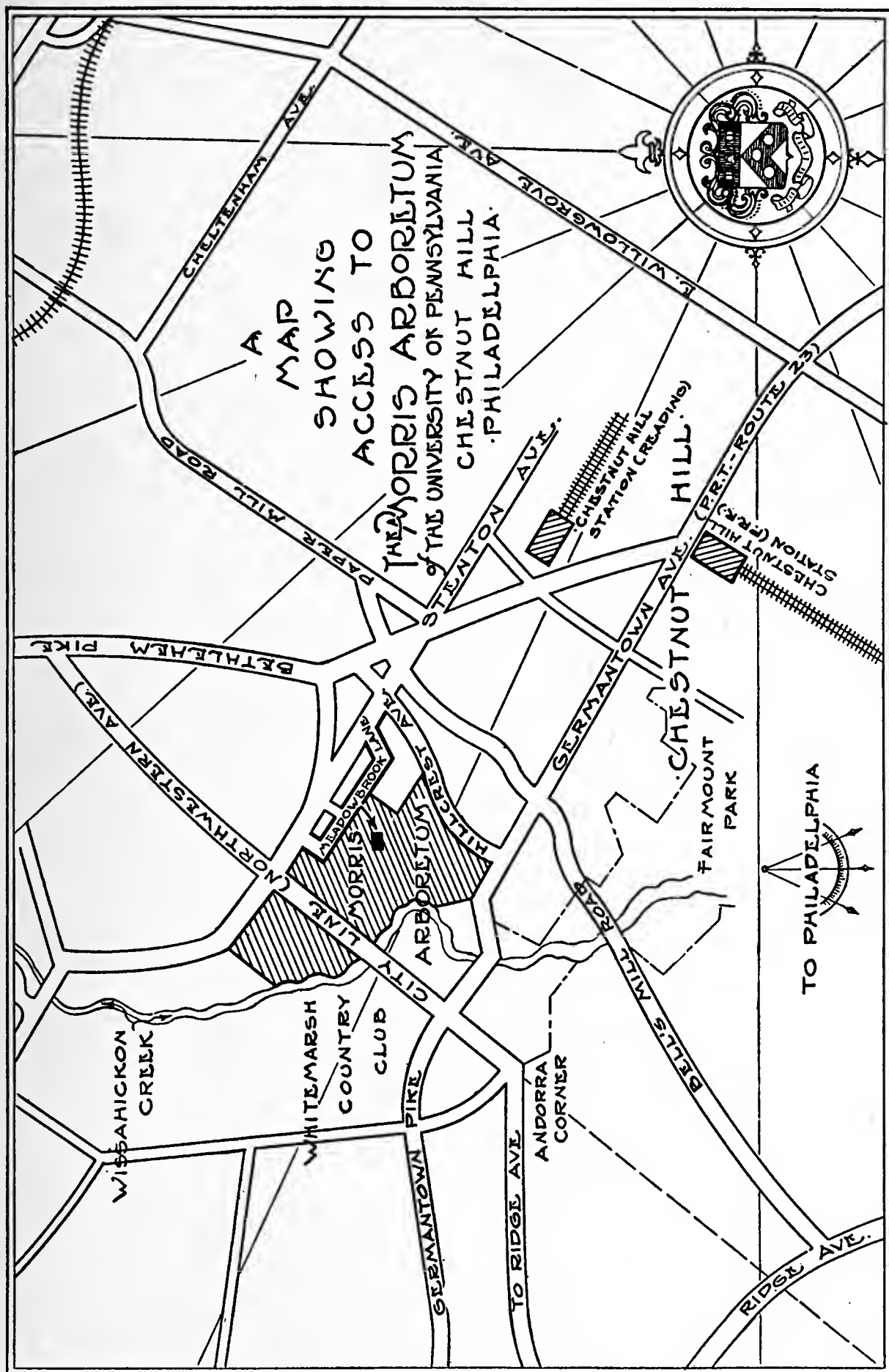
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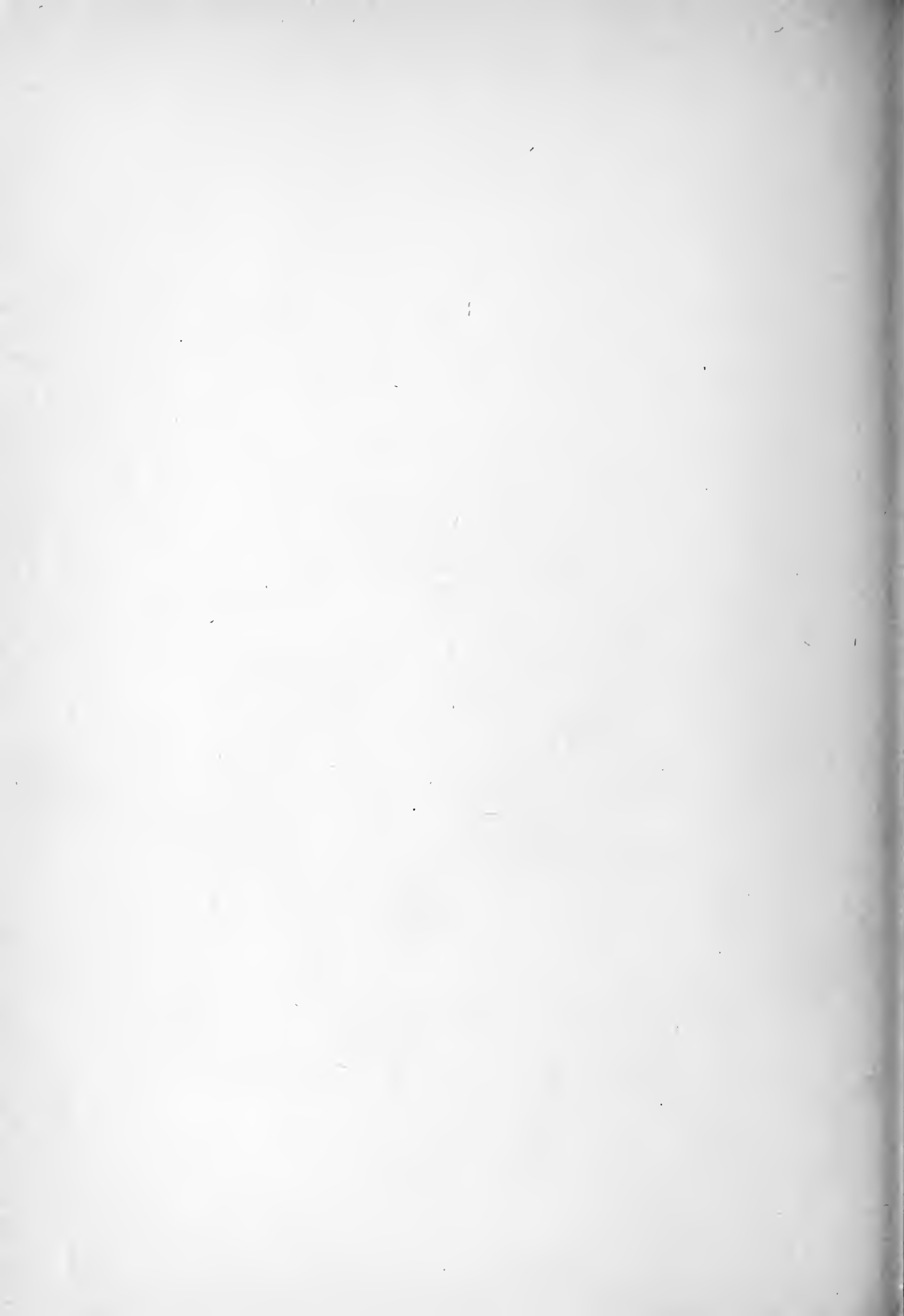
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OF THE
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OCTOBER, 1937



THE
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OF THE
UNIVERSITY OF PENNSYLVANIA

VOL. 2 No. 9

MORRIS ARBORETUM
CHESTNUT HILL
PHILADELPHIA, PA., U.S.A.

Ser

THE MORRIS FOUNDATION
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THE
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Austrian Pine
Pinus nigra Arnold variety *austriaca*
Aschers. and Graebn.

ARBORETUM BULLETIN, OCTOBER, 1937

The tree shown in the frontispiece is a specimen of Austrian Pine growing in the Arboretum. This is one type of the very variable species—*Pinus nigra* Arnold var. *austriaca* Aschers. and Graebn.—that occurs in southeastern Europe from Austria to the Balkan Peninsula. It forms a tall tree with dark grey bark. Its very dark green, rigid leaves growing in twos are three to four inches long. The cones are not stalked, are egg-shaped in outline, yellowish-brown and glossy. They are usually two to three-and-a-half inches long, each scale ending in a very short prickle. The gray seeds are about a quarter of an inch long.

This tree is hardy in our climate, and reaches a height of 100 or even 150 feet (Bailey).

The cover illustration shows the iron weather-vane on the summerhouse in the Rose Garden at the Arboretum.

These photographs were taken by Gustave Liebscher.

RODNEY H. TRUE, *Director*

BOTANY AS A HOBBY

THE SAYING that "every man should have two strings to his bow" probably originated a long while ago, but the intense life forced on people by our present mode of living calls attention to the fact that it is advisable, and indeed necessary, that some form of secondary interest should enter into the program of most of us, in order that the main job of life may be carried on successfully.

The hobby represents the "second string to the bow." Different types of interest will determine the sort of thing that a man turns to as a secondary interest.

His hobby may be collecting something—stamps, coins, medals. One of our former diplomats collected shaving bowls; one of our famous botanists collected death masks. All of these illustrate the operation of the "Sammelgeist."

To those with limited physical capability, the collecting of first editions or of engravings might offer a very genuine appeal, to which one might turn in moments of relaxation from the dominance of the job.

Many persons find their hobby in some form of physical activity. Witness the man who can hardly wait to get to his golf clubs in order to compete with "bogey." Others find their relaxation in different sorts of physical efforts. The athletic hobby has the usual advantage of taking the man out-of-doors and into the open air, with more or less physical exercise to keep his muscles in tone, and for the moment to take his attention from the regular job.

A hobby ought to furnish relaxation and a change of base for mental operations. It is preferable that fresh air and pleasant surroundings should add their zest. I think of Botany as a hobby combining all of the points just mentioned. One of the commanding figures in the iron world collects sedges, and in doing so undoubtedly gets into the open air, and finds much varied exercise in seeking his treasures in various types of surroundings. He may work in the marshes, or he may climb mountains for his *Carexes*. When he has found a species that he has never collected before, undoubtedly he gets a real thrill. One textile manufacturer has become an authority on ferns. A patent lawyer in New York City became one of the highest authorities on a group of the sedges. Examples of botany as a successful hobby might be multiplied.

As the hobby continues to operate, collections of plants are accumulated in many cases until the results of hours of relaxation become scientifically significant. Frequently these private herbaria find homes in some University or other institution of learning, and continue through the years to serve science and to inspire and to instruct other students and hobbyists. Thus, the objects of passing interest in hours of relaxation become permanent additions to the equipment of the world of scholarship.

What Andrew Mellon did for the present and for the future of art by collecting paintings is a recent instance of the natural course of the life history of a hobby. Our herbaria are full of similar instances illustrating a like story of botanical hobbies.

HOW TO MAKE A HERBARIUM

A HERBARIUM is a collection of plants preserved, usually by drying, for scientific study. To utilize space and to reveal the characteristics of the dry plants more clearly, the fresh specimens are put under pressure, and when dry are mounted on sheets of stiff white paper bearing a label giving the name, type of situation in which the plant is found, where collected, when, and by whom. These mounted plants are then arranged in some orderly fashion to make convenient the finding of desired specimens. Since insects are apt to eat dried plants, they are usually kept in closed spaces in which they may be exposed to fumes of insect repellents.

To collect plants for preservation is not a formidable process. The plant hunter may carry a portfolio consisting of two sheets of press board, or of some other stiff material, held together by two straps. Between these covers, sheets of newspaper are carried, folded once, to receive the specimens. Since the usual size of paper used for mounting plants in an herbarium is $11\frac{1}{2} \times 16\frac{1}{2}$ inches, it is best to arrange the specimen, when it is placed in the collector, with this fact in mind.

If one wishes to keep his specimens, it is well to make notes while the plant is fresh, indicating colors, sort of place in which it was growing, location, and date. Thus, errors of memory are avoided.

On returning home, or soon after, the newspapers with their plants are laid between blotters and placed under pressure. If berries or bulky things are collected, soft pads of cotton batting, folded in paper, may be used between newspapers and the blotters to distribute the pressure and to protect soft structures.

If the blotters are changed daily at first, and at longer intervals later, the plants may often be dried out without great loss of color. The foliage and perhaps flower colors may also remain.

To mount the dried specimens, narrow strips of thin gummed tissue are placed across the plants in proper places to hold them to the sheets. The label usually goes in the lower right-hand corner of the sheets to which the plants are fastened.

As the collection grows, paper covers are used to keep together plants in the desired groups, such as species or genera. In time, an active collector finds his herbarium a place in which he will spend many hours if he chooses, in arranging his plants and in recalling field experiences. There are usually pleasant memories in the herbarium work.

All of this sounds pretty formidable, perhaps, but the herbarium grows slowly and with it the demand on time and other resources.

The herbarium of one of the well-known botanists of the west, when seen by the writer, was kept in a packing box filled with shelves and set on a table placed in an alcove off the kitchen. His plants, not mounted, were kept in the newspapers, with small projecting tabs indicating groups, such as genera, etc. Since he was a man of small means, this served his purpose, and later his collection came to be highly valued and had appropriate care.

PLANT COLLECTING TRIP

FOLLOWING CUSTOM, the Arboretum and the Department of Botany of the University of Pennsylvania, after the close of the school year, went on a botanical foray to a section of Pennsylvania not well represented in the University Herbarium.

The personnel consisted of members of the staff, graduate and undergraduate students majoring in botany. Wives of the members of the staff took charge of the commissary aspects of the situation, and tourist cabins were the characteristic stopping places. Botanists are never too particular about their surroundings, and the rough-and-ready appearance of the group suggested the character of the work.

About a week was spent in collecting in Carbon, Luzerne, Lackawanna and Susquehanna Counties. Last year, on a similar expedition, Wayne and Pike Counties chiefly were investigated. Various botanical interests represented in this bus party brought in a wide variety of types of vegetation.

Professor John M. Fogg, Jr., Taxonomist of the Arboretum, who was an active member of the party, has kindly sketched the most interesting botanical features of the trip:

"The first day was spent in exploring the summit and slopes of the Blue Mountains at Little Gap. As these mountains here form the boundary line between two counties, the party was split into two groups, one unit collecting on the northern or Carbon County slope, and the other covering the southern face which is in Northampton County. The southern party met with a rather uniform flora of mixed, deciduous woodland, with little of real interest, but the Carbon County group found a vegetation that was characterized by a strong Canadian element. Among the many significant plants found were Fire Cherry (*Prunus pennsylvanica*), Striped Maple (*Acer pennsylvanicum*), and Round-leaved Dogwood (*Cornus circinata*). All of these are far-ranging northern species, which are seldom found south of the Blue Mountains in Pennsylvania. They provided a reliable sample of the type of vegetation which the party was to encounter during the remainder of the trip. One of the most interesting and widespread plants seen here was the Fly Poison (*Amianthium muscaetoxicum*), which made almost as spectacular a show as at the station in Pike County, visited by the 1936 bus trip.

"The following day, June 24th, was devoted entirely to Carbon County, an attempt being made to examine as many different habitats as possible. The first stop was at the foot of Flagstaff Mountain in Mauch Chunk, which yielded, among other species, the Red-berried Elder (*Sambucus racemosa*), already in young fruit. Considerable time was spent in the Bear Creek Swamp, near Christmans. A few of the more noteworthy finds made here were Goldthread (*Coptis groenlandica*), Painted Trillium (*Trillium undulatum*), Dwarf Raspberry (*Dalibarda repens*), Bunch berry (*Cornus canadensis*), and a rare species of Jack-in-the-pulpit (*Arisaema Stewardsonii*), which differs from the common woodland form (*A. triphyllum*) chiefly in its beautifully fluted spathe.

"The scene of activities then shifted to an area northeast of Albrightsville. Here the scientific personnel was divided into three sets. One unit ascended Lake Mountain and brought back Mountain Ash (*Sorbus americana*) and Bunch Berry. A second group explored the shores of Grass Lake and found Sweet Gale (*Myrica Gale*), Mountain Holly (*Nemopanthus mucronata*), Rhodora (*Rhododendron canadense*) and Bog Laurel (*Kalmia polifolia*). The third party made a quick dash to Round Pound and back, bringing with them Stiff Clubmoss (*Lycopodium annotinum*), a Quillwort (*Isoetes Braunii*) and a Bladderwort rare to this part of the state (*Utricularia purpurea*). They had also found, at the only station discovered by the party in Carbon County, an interesting northern member of the lily family, *Clin-tonia borealis*.

"On June 25th, the party made the ascent of Penobscot Knob in Luzerne County, primarily for the purpose of collecting a rare northern species of Cinquefoil (*Potentilla tridentata*). This plant, which has long been known to occur in this locality, has been reported from but two other stations in Pennsylvania. It was found here in great profusion on the bare rocky summit of Penobscot Knob at an altitude of about 2200 feet. It was in full bloom on this date, its attractive white flowers making a splendid show. The summit of the mountain was also dotted with Fly Poison and the delicate little Harebell (*Campanula rotundifolia*). The entire vegetation here was dwarfed and stunted, and a baffling array of oaks, blueberries and service-berries was collected for careful study.

"The party was joined in Scranton that evening by Mr. Stanley L. Glowenke, who acted as guide for the remainder of the trip. The first collecting on Saturday, June 26th, was done along the south branch of the Tunkhannock Creek, near Mont-dale, in Susquehanna County. Among the novelties found here were Mountain Sorrel (*Oxalis montana*), Acute-leaved Hepatica (*Hepatica acutiloba*) and Red Raspberry (*Rubus idaeus*, var. *strigosus*).

"The climax of the whole expedition came with the ascent and exploration of the Elk Mountains, which occupied the remainder of the day. These mountains, which are the highest in northeastern Pennsylvania, are heavily wooded and extremely wild. Here again the party broke up into groups in an endeavor to cover as wide a territory as possible. Lack of space forbids mention of all but a few of the many exciting discoveries made on the two knobs and richly wooded slopes of the Elk Mountains. Probably the most significant species were two rare orchids (*Habenaria hyperborea* and *H. orbiculata*) found in some abundance at the foot of the South Knob. Rivaling these in their interest for the botanist were two species of grasses, never before collected in this part of the State. The Red Baneberry (*Actaea rubra*), seen nowhere else on the trip, was abundant here, together with Large-flowered Trillium (*T. grandiflorum*) and Oak Fern (*Phegopteris Dryopteris*). The region yielded many species new to Susquehanna County, and at least two apparently new to the State.

"This ended the intensive collecting of the expedition, although a few brief stops on the way back to Philadelphia were made in Monroe and Northampton. In all over a thousand numbers were collected, many of them in duplicate or in triplicate,

furnishing a bulk of material which will go far toward increasing our knowledge of the flora of northeastern Pennsylvania."

The cost of the expedition was reduced to a minimum, and those of the party who enjoy plant study in the open found not only scientific results, but also something of the vacation spirit. By having an orderly plan of exploration, we shall be able to widen and deepen our knowledge of the wild flora of Pennsylvania.

Botanists in pursuit of plants almost necessarily reach out-of-the-way places, and the highlands of Pennsylvania and its rugged scenery are much better appreciated after one has viewed it from Penobscot Knob, near Wilkes-Barre, and from Elk Mountain, in Susquehanna County. The botanist's attention is not altogether monopolized by what he finds growing at his feet.



ARBORETUM NEWS

Scientific Staff

During the past summer, members of the scientific staff of the Arboretum were engaged in a variety of activities in the field and at home.

DR. H. H. YORK, Pathologist, continued his investigations on the forest diseases of New York, his work being mainly concentrated at Spring Water, New York.

DR. E. T. WHERRY, Ecologist, taught a class in botany in the Summer School of the Rocky Mountain Biological Laboratory, in Gunnison County, Colorado. He spent much time in collecting the ferns of Colorado, visiting a majority of the counties of the state in his work.

DR. J. M. FOGG, JR., Taxonomist, taught a class in botany at the Mountain Lake Summer School of the University of Virginia, at Mountain Lake, Virginia. He collected actively for the Herbarium, bringing back approximately a thousand plants.

DR. CONWAY ZIRKLE, Geneticist, spent his summer in Philadelphia, and continued his cytological studies in the laboratory at the Arboretum.

The Director, DR. R. H. TRUE, spent several weeks in Maine, where he collected actively for the Herbarium. Much material came from a botanizing trip to Moosehead Lake and the vicinity of Mt. Katahdin.

Improvements at the Arboretum

During the summer much-needed work was done at the Arboretum.

Five of the principal buildings received a fresh coat of paint.

The board fence around the Farm has been replaced by a four-rail fence with concrete posts.

The scientific equipment of the Arboretum has been greatly improved by the purchase of modern apparatus for weather observation. After proper installation, the following observations can be carried on: Temperature, relative humidity, wind velocity, rain and snowfall, and barometric pressure. It is hoped that a more accurate knowledge of these conditions may contribute to the scientific work of the place.



WINTER LECTURES

THE Lecture Course at the Morris Arboretum for the coming winter season will deal with plants in various types of ornamental groupings. The speakers are well-known authorities in their several lines. As heretofore, summaries of the lectures will be printed in the Bulletin. The program follows:

December 11, 1937

DR. EDGAR T. WHERRY

Native Plants for our Gardens

Dr. Wherry is a well-known contributor to horticulture from the Botanical Department of the University of Pennsylvania. He will give some attention to Rock Gardens and Wall Gardens.

January 8, 1938

MR. A. F. W. VICK

Wild Gardens

Mr. Vick has been actively developing this special phase of Botany for some time, and his work has been seen at the Philadelphia Flower Shows.

February 12, 1938

MRS. HOLLIS WEBSTER

Herb Gardens

Mrs. Hollis Webster, of Lexington, Massachusetts, will speak on Herb Gardens, a matter on which she has frequently lectured.

March 12, 1938

MR. CHARLES L. TRICKER

Water Gardens

Mr. Charles L. Tricker, of Saddle River, New Jersey, will speak on Water Gardens, a subject with which the name of Tricker has long been associated.

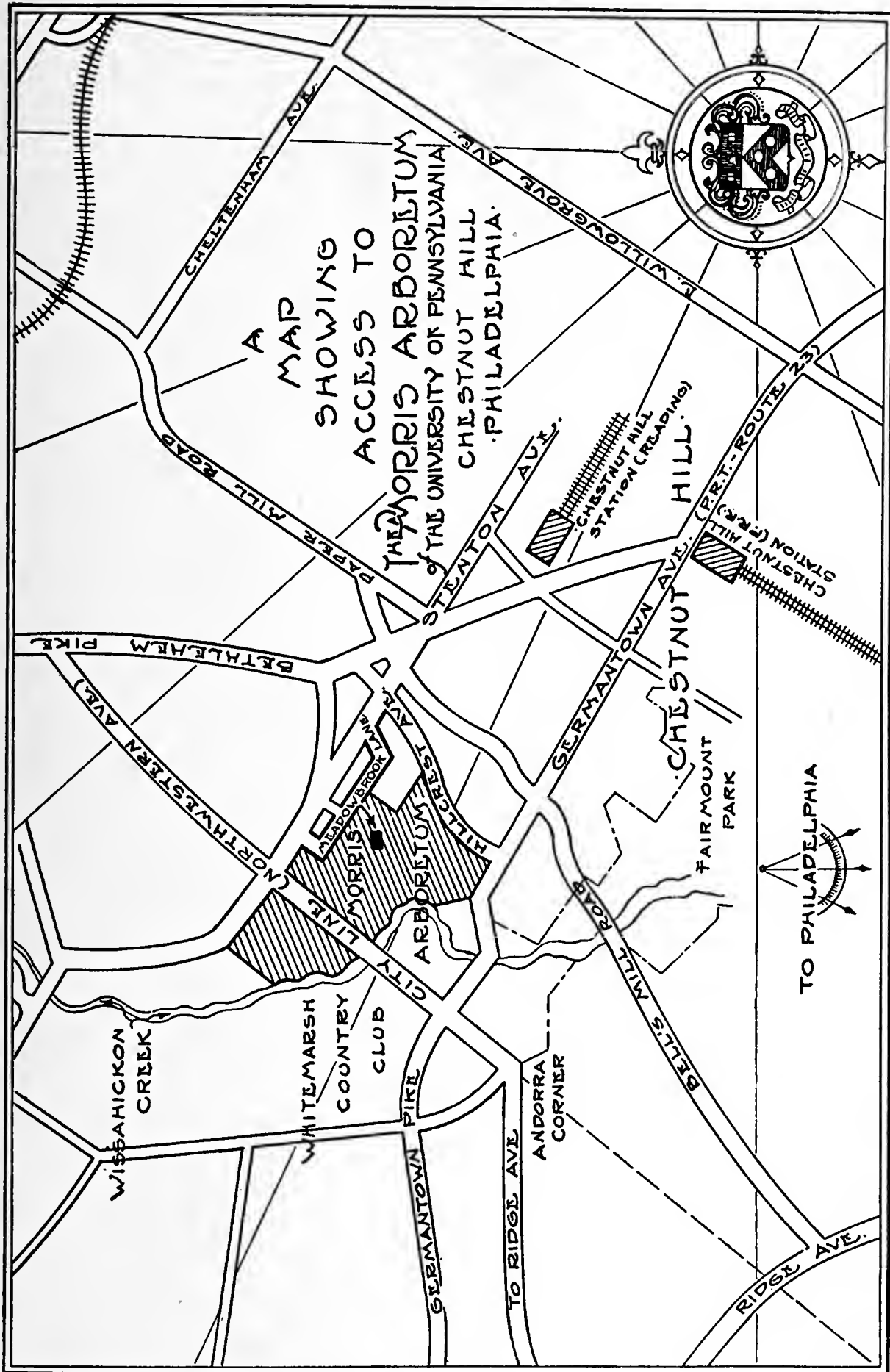
April 9, 1938

MR. ROBERT S. STURTEVANT

Beds and Borders

Mr. Robert S. Sturtevant, of Groton, Massachusetts, a well-known landscape architect, will speak on Beds and Borders, covering perhaps the more usual types of planned ornamental groupings.

The lectures will be given in the auditorium of the Morris Arboretum, at Chestnut Hill, on the second Saturday of each month, at 2:30 o'clock. All will be illustrated in one way or another. Admission is free, and cars may be parked opposite the entrance on Meadowbrook Lane.







ARBORETUM BULLETIN
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JANUARY, 1938



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THE
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Japanese Red Pine
Pinus densiflora
Sieb. and Zucc.
var. *umbraculifera* Mayr.

ARBORETUM BULLETIN, JANUARY, 1938

The pine that forms our frontispiece today is the Japanese Red Pine, *Pinus densiflora*, Sieb. & Zucc.

This tree has spreading branches, forming an irregular flattish top, and the branchlets have a striking yellowish-brown bark. The tree may reach a height of 100 feet, but it is cultivated in low-topped forms, of which that seen in the picture is one. It is the variety *umbraculifera* Mayr.

The leaves, growing in twos, have a bright green color and reach a length of from $2\frac{1}{2}$ to 5 inches. The short-stalked cones are grayish-brown, conic-ovate to oblong in form, with short prickles on the scales toward the base of the cones. (Bailey.)

The pagoda shown on the front cover is from the Japanese Garden at the Arboretum.

The photographs were made by Gustave Liebscher.

RODNEY H. TRUE, *Director*

NATIVE PLANTS FOR OUR GARDENS*

—BY—

DR. EDGAR T. WHERRY

THE MAJORITY of the plants which grow in small, informal gardens, and in particular, rock gardens, come to us from remote corners of the earth. There are, however, numerous native species to be found within a few hundred miles of our large eastern cities well worthy of the horticulturist's attention. Some of these are already in the trade, being offered by a few dealers who specialize in native plants. Others can be collected in the course of trips to places where man's activities have not yet destroyed the natural vegetation.

The mere fact that a plant is wild, and at first sight looks attractive, cannot be taken as an indication of its desirability for bringing it into a small-scale rock garden. There are certain species which spread so rapidly and so persistently by rootstocks, stolons, or other means, that they must be kept out at all costs.

Before attempting to transplant a native whose behavior is unknown, some observation should be made of the way it spreads, and if it forms vast colonies to the exclusion of other species, beware! Examples of what to avoid are: Bracken, hay-scented fern, lady-fern, chickweeds, buttercups, mustards, blackberries, some members of the evening primrose family, especially the rose-flowered *Oenothera* species, many milkweeds, dogbanes, morning-glories, mints and asters.

A list may now be given of native plants suitable for small rock gardens or wild gardens, which are relatively easy and safe to grow, not being particular as to soil or climatic conditions. (Slides of these were shown.)

Christmas Fern, and evergreen wood ferns, for holding shady slopes.

Cliff ferns (*Woodsia* sp.) and cliff brakes (*Pellaea* sp.)

Dwarf Spiderworts (*Tradescantia* sp.) from the Southern Appalachians.

Allium stellatum and other delicate native onions, but look out for *Allium cernuum*, which seeds too freely.

Many Trilliums, notably Snow Trillium (*T. nivale*) and Golden Trillium (*T. discolor*).

Iris cristata, a splendid dwarf species for dry rocks.

Rock portulaccas (*Talinum* sp.).

Catchflies (*Silene* sp.), including *S. pennsylvanica* and *S. virginica*.

Hepatica, especially *H. acutiloba* from the uplands.

Columbines, notably *Aquilegia canadensis*.

*Abstract of lecture given at the Arboretum on Saturday, December 11, 1937, by Dr. Wherry, Associate Professor of Botany, University of Pennsylvania.

Dutchman's Breeches, such as the Ozark form of *Dicentra cucullaria* and the Appalachian *D. eximia*.

Stonecrops (*Sedum* sp.); *Sedum ternatum* for a ground cover for shady places, and *Sedum pulchellum* (annual) and *S. telephioides* for sunny rocks.

Foam Flowers, *Tiarella cordifolia* and *T. wherryi*.

Saxifraga virginensis, the little native Saxifrage.

Violets, such as Longspur Violet (*V. rostrata*) and Yellow Violets (*V. hastata* and *V. pubescens*), but avoid quick-growing ones.

Pachystima canbyi, a tiny evergreen ground cover.

Pachysandra procumbens, the native American Mountainspurge.

Cacti, such as the native *Opuntia calcicola*, *compressa* and *humifusa*.

Pepper-and-Salt (*Erigenia bulbosa*), a tiny member of the carrot family, blooming in the early part of spring. (Avoid most of this family.)

Bearberry (*Arctostaphylos uva-ursi*), a fine ground cover for dry rocks, one of the few members of the heath family that withstands limestone.

Shooting Stars (*Dodecatheon amethystinum*, *meadia*, and others).

Spring Polemonium (*Polemonium reptans*), very adaptable.

Blue-Eyed Mary (*Collinsia verna*), a winter annual.

Rock Petunias (*Ruellia ciliosa*), and others.

Harebell (*Campanula rotundifolia*).

Many of the above will grow in partial or even deep shade, furnishing an answer to the constantly-arising question: What shall we grow in a rather shady rock garden?

Success in cultivating any native species can be judged by the appearance around mature, adult plants, of young ones, resulting from dispersed seeds or from some structure producing increase in a vegetative manner. For, when the older plant dies, as it will when its normal lifespan has been attained, a new individual of the same species will be available to take its place.

Many species of native plants are decidedly sensitive to environmental conditions, and cannot be transplanted at random and be expected to thrive. For them it may be important whether the rock garden is shady or sunny, moist or dry, warm or cool in summer, acid or alkaline, and so on. Control of the two features listed first is relatively simple and needs no special discussion. The temperature of the soil in summer may, however, be a limiting factor in success with plants which come from much farther north, or from higher elevations, than the garden being developed. The soil can be kept cool to some extent by shading it from the direct rays of the sun, but a continuous supply of evaporating water is far more effective. This accounts for the success of the structure commonly known in rock-gardening as the "moraine," in which water is always maintained amid coarse rocks at some depth, and is brought to the surface by capillary action in the finer, overlying material. The plants growing here do not need the water as such, and indeed will often rot if it is allowed to

accumulate around their crowns, but the cooling produced by the evaporation of this water at the soil surface aids the growing process.

There are a number of native species, some of the greatest attractiveness and desirability, which prefer or require a fairly acid soil. When it is desired to grow them, a testing set should be obtained, and the soil tested with dyes which show color changes with different degrees of acidity or alkalinity. A rock garden for such plants must be built with sandstone, granite or other rocks which contain no rapidly soluble lime, and limestone rock must be excluded. Peat moss, rotten sawdust, oak leaves, etc., must be freely used to furnish acid humus. A selected list of these plants follows: (Slides shown.)

Appalachian Spleenworts, such as *Asplenium montanum*.

Rusty Cliff Fern, *Woodsia ilvensis*.

Rose Spiderwort, *Tradescantia rosea*.

American Lily-of-the-Valley, *Convallaria majuscula*.

Rosybell, *Streptopus roseus*.

Painted Trillium, *Trillium undulatum*. Must also be kept cool.

Violet Iris, *Iris verna*, a southern dwarf species.

Hexastylis species, the southern evergreen wild gingers.

Wineleaf Cinquefoil, *Potentilla tridentata*.

Dwarf Dogwood, *Cornus canadensis*. Keep soil cold in summer.

Trailing arbutus, *Epigaea repens*, and most of the other members of the heath family.

Sand Myrtles, *Leiophyllum buxifolium* and vars.

Dwarf Blueberries, such as *Vaccinium pennsylvanicum*.

Rock Cranberry, *Vaccinium vitis-idaea*. Keep soil cool.

Galax aphylla.

Shortia galacifolia.

Fairy Bluebell, *Campanula divaricata* or *flexuosa*.

Golden Aster, *Chrysopsis mariana*. (Avoid most composites.)

In concluding the lecture, a series of slides of the Phloxes, on which the speaker is doing research work, were shown. Besides *P. subulata*, widely used in rock gardens, the following were recommended, especially for more or less shaded areas:

Phlox bifida and *P. nivalis*, relatives of *P. subulata*, with fewer flowers, but with especially attractive colors and forms.

Phlox divaricata, both vars. *canadensis* and *laphami*.

Phlox pilosa, various color forms.

Phlox ovata, especially var. *pulchra*.

Phlox stolonifera, a splendid woodland ground cover, with various color forms from purple to violet and lavender.

BERRY-BEARING SHRUBS AND TREES

FOR THOSE of us who are constantly in touch with the Morris Arboretum, the changes brought about, as one season gives way to another, afford a never-ending procession of beauty for our enjoyment. When we speak of the "beauties of nature," most of us immediately think of spring and summer, with their brilliantly colored flowers and their green foliage, but autumn brings us a beauty of its own. While it is true that the fall of the year is a season when most plants become dormant or die, the brightly tinted foliage and berries afford one last burst of color and gaiety before the long, dull winter comes.

During the past year, the berried shrubs and trees seemed more profuse and beautiful than for many years past. Possibly this is due to their rally from the severe winters of 1934 and 1935, that destroyed many of our trees and shrubs. Whatever the reason may be, both the fruits and flowers have outdone themselves in presenting a glorious show of color and beauty.

This fact alone has brought to our attention, more clearly than ever before, the value of shrubs and trees with brilliantly colored berries. The berries come when most of the flowers have gone. Hence, a few judiciously chosen and well-placed shrubs of the berried varieties will do wonders for a landscape that otherwise would become drab and uninteresting in early autumn.

In recent years, the amateur gardener, with the limited space surrounding his home, has learned the value of selecting appropriate flowers. The use of berried shrubs brings an additional resource for this type of landscape work.

At a recent meeting of the Germantown Horticultural Society, the Morris Arboretum presented a most interesting display of berried shrubs and trees. Later, the same display was shown at a meeting of the Botanical Society of Pennsylvania, where Mr. Edwin Matthews, of the Outdoor Arts Company, discussed the value of berried shrubs both from the decorative and the utilitarian points of view. The display consisted of 98 species and varieties, representing some eighteen genera. Herein were presented practically all the colors found in the spectrum, and it is easily seen how a brilliant display can be made from these types.

Among them the *Ilex* species were outstanding. *Ilex decidua*, in particular, put forth an abundance of bright, clustered berries, while *Ilex verticillata* presented the larger, less numerous fruits. The Japanese Holly, *Ilex serrata*, is a smaller and more slender plant than *Ilex verticillata*. It has small berries, and a dainty, delicate appearance. *Ilex pedunculosa* is one of the evergreen hollies. The plant has spineless, rounded leaves, and is noteworthy for its rapid growth, and for a greater hardiness

than that of other evergreen Japanese Hollies. Its berries are more sparse than those of other varieties, and grow singly on long, slender stalks. We must not forget our native holly, *Ilex opaca*, which is so much associated with the Christmas season. It fruited in great profusion this past year. In growing this variety, it is necessary in order to have berries to plant two sexes, male and female, since this holly is dioecious.

The newer *Aronia arbutifolia brilliantissima* showed great improvement over the ordinary type in its brilliance of color and heaviness of fruit. *Nandina domestica*, commonly known as the "Heavenly bamboo," gains its name from the bamboo-like foliage beneath its scarlet fruits. The leaves, after the first frosts, assume a lovely red-bronze color that remains throughout a great part of the winter.

Pyracantha coccinea Lalandii (Fire Thorn), with which we are so familiar, displayed its fiery color to the utmost, and the many varieties of Barberry were exceptionally well-fruited.

There was, as well, the huge, heavily-fruited *Lonicera Maackii podocarpa*, forming a striking background for the display. Among the low-growing *Loniceras*, we have *Lonicera pileata*, a dwarf evergreen honeysuckle, with berries of purple-violet or amethyst. This is particularly useful and attractive when used in rockeries, or as an edging for a shrubbery border. *Lonicera nitida* is closely related to *Lonicera pileata*, but is a more upright shrub. The leaves turn a beautiful bronze color in the autumn, adding to the attractiveness of the shrub for rockeries. *Lonicera Henryi* is a half-evergreen honeysuckle, with fairly large black fruit. It grows either twining or prostrate, and is recommended in place of the common Japanese honeysuckle which, through its extremely rapid spread, often becomes a nuisance. *Lonicera Heckrottii*, though not grown for its fruits, is noteworthy for its beauty of flower, and for the fact that it continues to bloom from early summer until the first frost. *Leycesteria formosa* (Himalayan honeysuckle) is new to us. It killed back here, but in the following year it flowered and fruited nicely. It is an odd little shrub with its tubular, reddish-purple berries and, we are sure, will stand a great deal of experimentation on its uses.

Malus zumi, characterized by its beautiful red fruit and by its tall, handsome form, and *Malus Sieboldii* (Toringo Crab), which has red fruit, sometimes approaching yellow, were included, together with *Viburnum dilatatum* and *Viburnum theiferum*, which are always good.

Among the darkly-berried shrubs was *Ligustrum vulgare buxifolium*, with its lustrous black fruits and dark-green foliage, the latter being retained for the greater part of the year. *Ligustrum sinense Stauntoni* has berries with a more bluish tinge,

which grow in numerous clusters. This is a most graceful privet, excellent for use where a larger growing type than Regel's is desired, and it has proved hardy here at the Arboretum. In our display was included *Ligustrum acuminatum macrocarpum*, also covered with bluish-black berries, having the largest berries of all the privets.

One black-fruited shrub at the Arboretum, *Rhamnus crenata*, is most outstanding, because its fruits persist throughout the winter. Another plant of great value, a tree which we are proud to own, and which has this same characteristic, is *Phellodendron Lavalleyi*. *Phellodendron japonicum* is especially attractive to the birds, hence it is of great interest to those of us who desire to encourage birds to flock around our homes.

Again, for those who prefer the lilac and violet shades, there is the willowy *Callicarpa dichotoma* (*C. purpurea*) with its profusion of berries. However, this shrub is often injured by the first frost and early loses its beauty. *Callicarpa Giralddiana*, also with violet fruits, is similar to *Callicarpa dichotoma*, but grows to a greater height.

In *Euonymus Bungeana* we find a most striking contrast between the brilliant scarlet of its fruits, and the pale, delicate pink of its capsule. This is a particularly unusual combination, especially noteworthy since it is so seldom found in Nature.

In addition to the commonly grown Snowberry, we have *Symphoricarpus oreophilus* (Mountain Snowberry), a graceful shrub with slender, spreading branches, and smaller, almost snow-white berries. A variety of Indian Currant, represented here by plants received from the New York Botanical Garden as *Symphoricarpus orbiculatus elongatus*, has larger berries and a more graceful habit of growth than that of any other type we have previously seen. Another distinct variety is *Symphoricarpus orbiculatus leucocarpus*, particularly interesting because of its yellowish-green berries and its longer, more graceful branches. *Symphoricarpus Chenaultii* is one of the newer hybrids. Its leaves are daintier, and its entire appearance is one of greater neatness and delicacy than that of its near relatives. The berries are pinkish-red, and are covered with small pale dots, adding an unusual touch to the shrub.

The Cotoneasters were represented by *Cotoneaster divaricata*, an upright shrub of medium height, with slender branches graced with small, lustrous leaves and a profusion of bright red fruits. Contrasted with this was *Cotoneaster acutifolia villosula*, a graceful, strong-growing variety, with large leaves and conspicuous black fruits. *Cotoneaster Dielsiana* is handsome indeed, and particularly good when grown on a single stem, for then the slender, pendulous branches are seen to the best advantage. Representing the medium growth, we have *Cotoneaster Zabeli*, another

handsome shrub characterized by red fruit. Let us not forget, either, the little, low-growing *Cotoneaster horizontalis*, with its peculiar branching effect. This is excellent in rockeries because of the brightness of its berries and the tenacity with which it holds them, as well as the leaves.

Cotoneaster salicifolia floccosa has been found growing profusely in the garden of Mrs. Chauncey H. Peacock, at 20 West Waterman Avenue, Chestnut Hill. This is by far the most outstanding *Cotoneaster* we have seen in this locality. Even after Christmas, the shrubs were still laden with berries, and made a beautiful entrance for the home. Having seen this excellent display of them, we are led to hope that this shrub will in the future be more widely grown in and around Philadelphia, as well as in other localities where conditions are favorable.

The plants of which we have spoken, together with many others, composed our collection of specimens. In presenting this exhibition, we were mindful of its educational as well as esthetic value. To this end, the collection of cut specimens exhibited at these meetings was distributed to school teachers and garden clubs, in order that a larger number of people might study them in detail, and therefore come to a greater appreciation of the shrubs as seen in the growing state.

We wish to express our thanks to our friends of Princeton University, and of the Scott Foundation of Swarthmore College, for their contributions of several specimens, with which we completed our collection.

JOHN TONKIN



RAISING FERNS FROM SPORES

THERE ARE several methods by which ferns may be propagated, each being dependent upon the type of plant and material available. By far the most common method used in present-day practice is the sowing of spores. This gives the greatest number of plants, requires less space than other methods, and is comparable to seed-sowing of flowering plants.

There are types of ferns that exhibit various characteristics developed by nature for the purpose of vegetative propagation. With the exception of the old type Boston fern (*Nephrolepis exaltata bostoniensis*), the genus *Nephrolepis*, particularly the varietal forms, do not produce spores, but instead develop runners, which give rise to new plants. The walking fern is a similar illustration of vegetative reproduc-

tion. *Asplenium bulbiferum* is a type which demonstrates the multiplication of plants by vegetative growths in the form of bulbils, which are reproduced in abundance on the fronds. The water fern, or *Ceratopteris*, is a type producing marginal vegetative buds that develop rapidly and become detached from the leaf and form independent plants. This type of reproduction is also exhibited in the flowering plant, *Bryophyllum*, or sprouting leaf. The long rhizomes of the Formosa type of fern (*Davallia*), when cut into sections, form one of the easiest and quickest means of obtaining mature plants. Even when spores are available, it is often advisable to increase one's stock by the "division" method. Plants such as the Boston and maiden-hair ferns, having a compact growth of many crowns, can easily be separated, so that one, or several crowns, become a separate plant.

The practice of successfully raising ferns from spores depends upon careful preparation of all materials. The preparation of the growing medium is a very important one. It is important that the soils should be composed of materials supplying a light, fine and water-retentive medium, free from all foreign organisms destructive to young fern growth. Many types of soils are used for germinating spores according to one's preference gained from experience. The soils should consist of loam, humus and sand. These may be made up of two, two, one; that is, loam two parts, humus two parts, sand one part, or, a mixture of one part of each. A combination that has proved very successful is three parts loam, two parts humus and one part sand. Commercial growers, for economic reasons, substitute peat moss for humus.

After the soil has been thoroughly mixed and screened to remove all pieces of wood and heavy solids, the next step in the preparation of the soil is sterilization to insure against contamination by fungoid diseases, and other injurious organisms that cause serious losses after germination has taken place.

The natural enemies of *prothallia* are fungi, algae, liverworts and moss protonema. Strong growing species of *Cyrtomium*, *Dryopteris* and *Adiantum* forms often smother and eventually kill weaker growing species. Recently, Michigan Soil Sponge Peat has been successfully used in growing fern *prothallia*. The advantage in using this material is that sterilization is unnecessary. It has no injurious foreign substance, retains moisture, does not pack, while acidity and food values contained therein appear to be well suited to the young developing fern plant. This material is benefited by an additional 10 per cent. of sand to increase porosity.

The receptacles for use in germinating spores may be pots, pans, flat boxes, or open greenhouse benches or frames. When pots or pans are used, the soil is placed in the receptacle, pressed moderately firm, and the surface leveled, then the soil is watered thoroughly with a fine spray, or, pots in saucers filled with water soak

the soil from below. The top of the pot should then be covered with glass to insure against contamination of any kind.

To insure germination, it is essential to select spores that are ripe. These may be identified by the rich brown coloring of the indusium or spore covering. Those having naked sporangia (no indusia), as in the *Polypodiums*, can be tested for maturity by gently brushing the spores with the finger. If the light golden spores adhere readily to the skin, they are ready for sowing. Should there be any doubt as to the degree of ripeness, it is a safe practice to cut the fronds, place them in a paper bag for a period of time to permit the shedding of some spores. When sowing spores in pots or pans, it is a good practice to waterlog the soil. Then, as the water recedes, the spores are evenly deposited on the soil surface. This prevents crowding or bunching of the young ferns. Spores must never be covered, but must remain on the surface of the soil to insure proper germinating conditions.

To obtain a pure culture of a given species, care must be exercised to prevent sowings from other species from becoming mixed. To safeguard against this, cover with glass immediately after sowing and place in a shady position. The glass covering should have a half-inch overlap to insure exclusion of other organisms. Each day these glasses should be turned over quickly, so that the under surface of the glass that holds the condensation is removed from the inside of the pot and injury from drip is eliminated. When large quantities are sown on an open greenhouse bench, a covering or "framing in" with cheesecloth is ideal. This should be kept far enough from the surface of the soil to allow free circulation of air. Cheesecloth acts as a shade, helps to retain moisture, and acts as a barrier against contamination. Subsequent waterings should be from below when possible. When overhead watering is necessary in large cultures, a fine spray that will prevent washing or disturbing spores or soil should be used.

When raising ferns from spores, it is important to know beforehand the necessary essentials required during the early stages of fern development. When a spore germinates, it does not develop immediately into a fern plant, as a seed develops into a flowering plant, but a spore develops a small, flattened, green heart-shaped structure known as a *prothallus*, which in turn develops sex cells in the *archegonia* (female) and *antheridia* (male). After fertilization has been effected, a rudimentary fern leaf appears, and as growth progresses, fronds characteristic of the species are developed, forming the true fern plant. When the plants have attained enough size for handling, they should be transplanted into the receptacles, allowing sufficient space for the proper development of the individual plant. The growing medium now becomes varied, according to the requirements of the species, varying from a light to a heavy combination. By adding or omitting humus from the combination, a

soil suitable to the requirements of different types of ferns can be supplied. As an illustration, the Boston fern prefers a heavy soil, the maidenhair (*Adiantum*), a lighter, porous soil, while the *Davallia* (Formosa Fern) requires Osmunda fern fibre or orchid peat. Humus lightens the soil, retains the moisture, and supplies the woodland organisms so beneficial to fern growth. The soil supplies the major food requirements and is the basis of all soil combinations. The amount of sand added is to insure the proper porosity of the soil, especially when combined with good drainage supplied at the base of the receptacle. When the plants have attained a size suitable for two-inch pot culture, they should be potted and grown on for repotting into larger sizes, as required, to bring the plant to maturity, or to a stage sufficiently large enough for outdoor planting.

Fern spores can readily be seen on the under surface of the leaves in the form of dots, stripes, chains, masses, or groups, ranging in color from white to golden or dark brown, according to the age or maturity of the sporangium or spore case.

The question is often asked how ferns can be rid of scale and other insect pests, which are so persistent on the under surface of fern fronds. The answer to this question is that these round, dark-brown masses are not scale or any form of insect life, but instead are the natural production of spores, which should never be removed unless needed for sowing. The spores may be spread over the entire under surface of the leaf, or arranged in definite single rows, in pairs, or solid bars on leaf margins or leaf tips, in some cases on entire fronds. Rarely spores are produced on the upper surface of the leaf of the Heart's Tongue Fern or *Phyllitis Scolopendrium*.

Ferns are classified according to the arrangement of the spores on the leaf. Occasionally, hybridization takes place in the prothallium stage when allied species are growing together. Artificial fertilization by hand, as practiced in flowering plants, is impossible with ferns.

For the purpose of increasing the number of species in our collection, and in doing so to increase the beauty and scientific value of the unique Fern House, The Arboretum has secured fern spores from many botanic gardens throughout the world. Many ferns from these sources are now growing in the Arboretum greenhouses, and of outstanding interest at the present time is a series showing the most interesting stages of development of the finest of all—the Stag's Horn Fern, *Platycerium grande*. That we do derive new species from these foreign sources demonstrates clearly that the vitality of fern spores is retained over a long period and under adverse conditions.

JAMES LAMBERT

ACKNOWLEDGMENTS

DURING THE six-months' period now closing, the Arboretum gratefully acknowledges the receipt of plants, seeds and cuttings listed as follows:

Ambler Nurseries, Ambler, Pa.

8 Species and Varieties, 16 Plants

Boyce Thompson Arboretum, Yonkers, N. Y.

18 Species and Varieties, 33 Plants

Cornell School of Ornamental Horticulture

35 Species and Varieties of Plants and Cuttings

John Gill, Haddonfield, N. J.

Clethra alnifolia, 1 Species, 2 Plants

Mrs. Arthur R. Iliff, Old Ambler Homestead, Ambler, Penna.

1 Large *Crassula*

Koster & Company, Bridgeton, N. J.

19 Species and Varieties, 40 Plants

Masonic Homes, Elizabethtown, Pa.

37 Species and Varieties, 124 Plants

Park Valley Nurseries, Prospectville, Pa.

3 Species and Varieties, 3 Plants

Westtown Friends' School, Westtown, Pa.

3 Species and Varieties, 18 Plants

Joseph J. White, Inc., Whitesbog, N. J.

1 Species, 1 Plant

Collected by members of the Arboretum staff on the premises of a member of the staff at Bell Station, Prince George's Co., Md.

15 Species and Varieties, 78 Plants

Collection by members of the staff.

15 Species and Varieties, 88 Plants

Seeds were received from the following sources:

Ambler Nurseries, Ambler, Penna.

Berberis Jamesonii and *Stewartia camellia*

Arnold Arboretum, Boston, Mass.

Quercus ellipsoidalis from Illinois

Barnes Foundation, Merion, Penna.

Hovenia dulcis

Samuel N. Baxter, Germantown, Phila., Pa.

Seeds of *Pterocarya stenoptera* from a Germantown tree, and *Taxodium mucronatum* from the largest tree in the world in Mexico

Botanical Garden of Basel, Switzerland

7 Packets

Botanical Garden, Berlin, Germany

45 Packets

Botanical Garden, Koeln, Germany

14 Packets

Botanical Garden of LaMortola Ventimiglia, Italy

17 Packets

Botanical Garden, Leyden, Holland

15 Packets

Botanical Garden of the University of Nancy, Nancy, France

1 Packet

C. C. Deam, Bluffton, Indiana

A very unusual variety of *Carya ovalis*

Dominion Experimental Farm, Ottawa, Canada

64 Packets

J. Dornan, Chestnut Hill, Philadelphia, Pa.

Ilex vomitoria and *Melia Azederach* collected in North Carolina

John K. Edwards, University of Pennsylvania

Asimina triloba, collected in Indiana

Marsh Botanical Garden of Yale University, New Haven, Conn.

7 Packets

Oliver M. Neal, Jr., North Berwick, Maine

18 Packets collected from native Maine plants

New York Botanical Garden, Bronx Park, New York

13 Packets

Northern Rocky Mountains Experiment Station, through the courtesy of the Scott Foundation, Swarthmore, Pa.

Pinus ponderosa

E. E. Wildman, Philadelphia

Cedrus libanotica, collected at the home of Mrs. Morris Dean, West Chester, Pa.

The Arboretum was generously supplied with Triogen during the rose season of 1937 by Mr. Edwin M. Rosenbluth, of Wallingford, Penna. Excellent results followed the use of Triogen.

CHANGES *in the* DEPARTMENT *of* BOTANY *at the* UNIVERSITY

On June 30th, Rodney H. True, who had been head of the Department of Botany at the University of Pennsylvania since 1920, was retired on account of age, and Dr. Jacob R. Schramm, Editor-in-Chief of BIOLOGICAL ABSTRACTS, was appointed to succeed him at the University. Dr. True remains as Director of the Morris Arboretum, with his headquarters at Chestnut Hill.

Dr. Schramm graduated at Wabash College in 1910, took his Ph.D. degree at Washington University, St. Louis, in 1913. After acting as Instructor in the Shaw School of Botany of that University, he became Assistant Professor, and then Professor of Botany, at Cornell University.

Among his many activities, he has served on the National Research Council as Executive Secretary of the Division of Biology and Agriculture. He has been Secretary, Vice-President and President of the American Botanical Society, and is a member of the American Philosophical and of other scientific societies.



DUTCH ELM DISEASE ERADICATION

THE PLANT DISEASE REPORTER, issued by the Division of Mycology and Disease Survey, Bureau of Plant Industry, U. S. Department of Agriculture, on September 1, 1937, reports for the weeks ending August 14th and August 21st the findings regarding 704 trees having the disease, confirmed by laboratory tests. Of this number 10 were in Connecticut, 514 in New Jersey, 177 in New York, and 3 in Indianapolis, Indiana.

That progress is being made in the battle with this disease is shown by the following confirmed occurrences:

LOCATION	1933	1934	1935	1936	1937
New Jersey	740	4,377	4,113	5,793	3,473
New York	77	2,427	2,258	1,741	982
Connecticut	1	56	76	102	91
Indianapolis	0	4	10	19	30
Totals	818	6,864	6,457	7,655	4,576

No cases were found in the following places, in which it had been found at earlier dates:

Cincinnati, Ohio
Athens, Ohio
Baltimore, Maryland
Brunswick, Maryland

Cumberland, Maryland
Norfolk, Virginia
Wiley's Ford, West Va.

R. H. T.

WINTER LECTURES

THE LECTURE COURSE at the Morris Arboretum for the coming winter season will deal with plants in various types of ornamental groupings. The speakers are well-known authorities in their several lines. As heretofore, summaries of the lectures will be printed in the Bulletin. The program follows:

January 8, 1938

MR. A. F. W. VICK

Wild Gardens

Mr. Vick has been actively developing this special phase of Botany for some time, and his work has been seen at the Philadelphia Flower Shows.

February 12, 1938

MRS. HOLLIS WEBSTER

Herb Gardens

Mrs. Hollis Webster, of Lexington, Massachusetts, will speak on Herb Gardens, a matter on which she has frequently lectured.

March 12, 1938

MR. CHARLES L. TRICKER

Water Gardens

Mr. Charles L. Tricker, of Saddle River, New Jersey, will speak on Water Gardens, a subject with which the name of Tricker has long been associated.

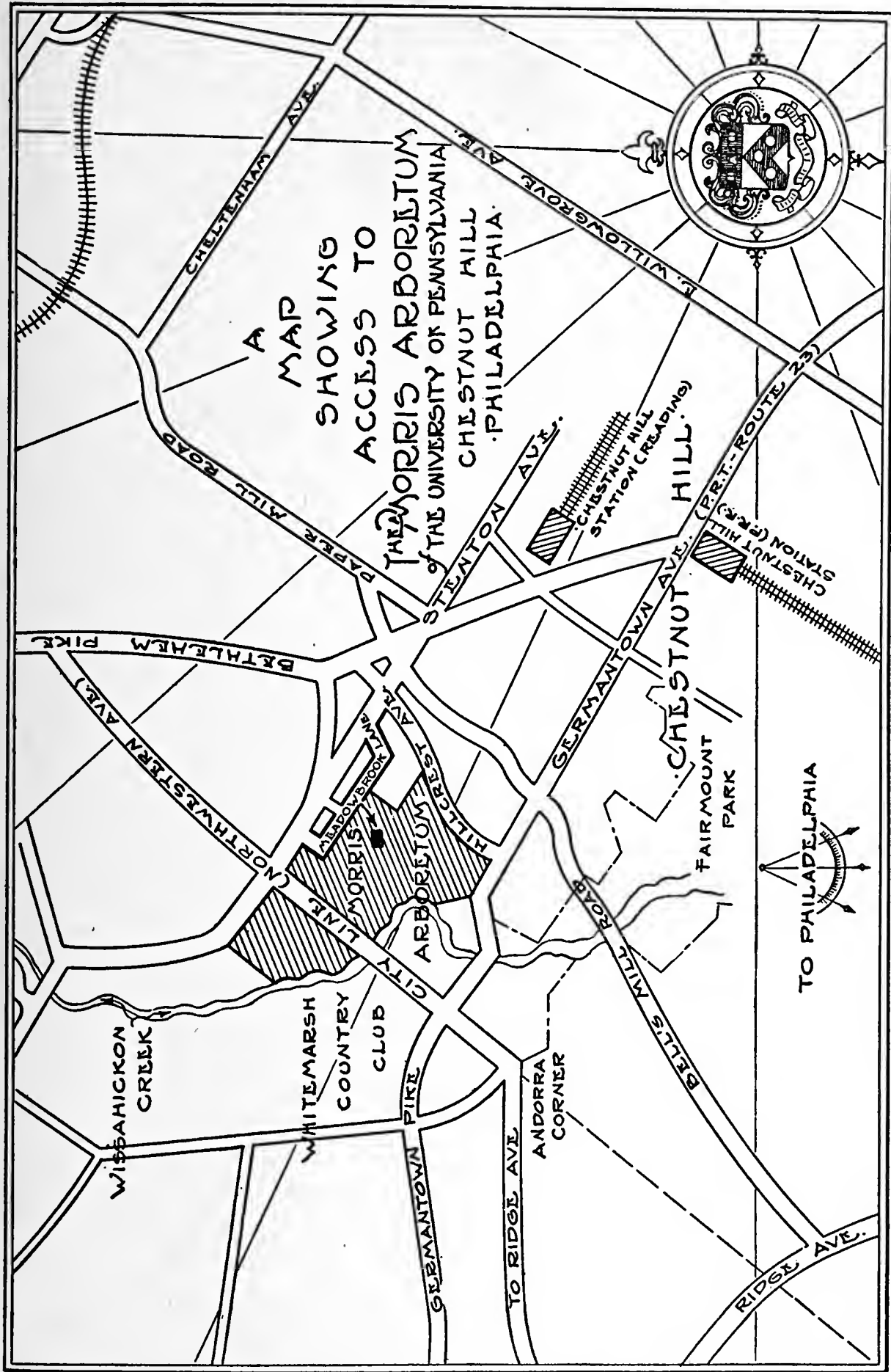
April 9, 1938

MR. ROBERT S. STURTEVANT

Beds and Borders

Mr. Robert S. Sturtevant, of Groton, Massachusetts, a well-known landscape architect, will speak on Beds and Borders, covering perhaps the more usual types of planned ornamental groupings.

The lectures will be given in the auditorium of the Morris Arboretum, at Chestnut Hill, on the second Saturday of each month, at 2:30 o'clock. All will be illustrated in one way or another. Admission is free, and cars may be parked opposite the entrance on Meadowbrook Lane.





ARBORETUM BULLETIN
OF THE
ASSOCIATES

—
APRIL, 1938



THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

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452

THE MORRIS FOUNDATION
Maintaining THE MORRIS ARBORETUM
OF THE
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THE
MORRIS ARBORETUM
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Korean Pine
Pinus koraiensis Sieb. & Zucc.

ARBORETUM BULLETIN, APRIL, 1938

The Korean Pine, *Pinus Koraiensis*, Sieb. & Zucc., is a hardy, handsome pine of slow growth and dense habit from Japan and Korea. Its pyramidal top may reach a height of nearly a hundred feet. The bark is scaly, gray-brown or gray. The straight, dark-green leaves are from $2\frac{1}{2}$ to $4\frac{3}{4}$ inches long. The short-stalked cones, from $3\frac{1}{2}$ to $5\frac{1}{2}$ inches long, are yellow-brown in color, the scales composing them being recurved and obtuse at the apex. (Rehder)

A specimen at the Arboretum was photographed for this illustration by Gustave Liebscher.

The cover drawing by Mr. Liebscher shows the Swan Pond and the Temple near the Head Gardener's Lodge on Hillcrest Avenue.

RODNEY H. TRUE, *Director*

WILD GARDENS*

—BY—

ALBERT F. W. VICK

A BIT OF RUGGED STREAM, open meadow, or deep woodland, can be reproduced in your own back yard as the slope, moisture or shade indicate. We have a wealth of gorgeous native plants, flowers and ferns practically excluded from customary planting lists, not because they are difficult to grow, but because we have somehow felt that we could improve on nature, as seen here, by using plants from foreign lands. We forget that nature has been planting on this continent of ours for a good many million years, and that she has definitely decided what will grow best under the various existing conditions. She made our streams and forests a blaze of glory.

We started the devastating destruction that some would have us believe necessarily accompanies the progress of civilization, and the conservationists are finding it difficult to stop the habit of thoughtless destruction. So-called nature lovers still pull and yank at everything beautiful within their reach, and each year destroy tens of thousands of plants.

Start your wild garden in a normal, sane manner. Make a soil test, then select from nature's plant treasures what is best suited to your soil conditions. No blue such as the blues of blue Lobelia or fringed gentian have been found in Persia, India, China or Japan. Oriental coloring has given us nothing to compare with our cardinal flower, and do you remember the tangle of deciduous holly, hazelnut, paw-paw, and wild plum, down by the stream on the old farm, or the dogwoods, Judas trees, azaleas, and Kalmia, that made the hillsides famous? What spring is complete without arbutus, hepatica, jack-in-the-pulpit and violets? Just put them in your wild garden where they belong and where they will be happy. If your soil tests acid, choose from the acid-loving plants, of course, watching their moisture requirements, and the same if the soil be alkaline or neutral.

The tiny perennials will need watering and weeding for a year, or two, or three, until your ground cover is thoroughly established and able to take care of itself to the exclusion of undesirable weeds. If possible, never cultivate. Your wild garden will grow more and more beautiful each day and year, and the less care you give it, the mellower and more intriguing the tangle will become.

*Abstract of lecture given at the Morris Arboretum on Saturday, January 8, 1938, by Mr. Vick.

Every wild garden should have a background. Nature's background for the dainty ferns and delicate wild flowers is a mass of rugged rocks, with a profusion of trees and shrubs, beneath which the colorful ground cover may find protection. Therefore, it is well to start with a stream or bit of woodland if you desire a successful wild garden. We believe in using the plants which belong there most naturally. Joe pye weed, purple or white boneset, iron weed, sun flower, cone flower, wild aster, even butterfly weed, can be used to form a glorious profusion of color in the damp meadow which is not too near to the residence. A bit of moist meadow near the house should be daintily and beautifully abloom in the spring with marsh marigold, mertensia and Jacob's ladder, in midsummer with wild senna, in late summer with cardinal lobelia, and in the autumn with blue lobelia, and both blind and fringed gentian. Considerable wooded areas can be rejuvenated, and their glory restored, with the return of the natural ground-cover planting. There is a peaceful majesty about the untouched woods, which has never been equalled in any cathedral or temple built by the hand of man. If you doubt this statement, go out in the woods the next time you are really angry through and through, and see how long your anger will last. 'Twill be forgotten in a short time, for you must worship at nature's shrine.

Dogwoods, the Judas tree, pawpaw, deciduous holly, American holly, leatherwood, azaleas, chokeberry, Indian currant, should all be protected and encouraged.

American deciduous trees and shrubs should be selected for their spring bloom and their autumn coloring, and should be interspersed with native evergreens. Spotted wintergreen, round leaf wintergreen, checkerberry, Kalmia, laurel, rhododendrons, hepatica, arbutus, a wide variety of ferns, button bush, spice bush, the wild roses, and a host of other beautiful native plants should be reestablished to give our woodlands the glory of color they once wore.

Of course, we are criticized for spending money to propagate wild columbine, trilliums, marsh marigold and ferns, when the woods are so full of specimens to be had for the taking, but consider what the results would be if we continued this true American habit of taking all from nature and giving nothing back. We have spent generations destroying plants through the cutting of timber, through careless and thoughtless gathering of huge branches and tremendous bunches of wild flowers. The results have been amazingly disastrous. Therefore, I would like to close with a quotation from James Vick, Sr., the famous horticulturist:

"God made man a being, pure and simple in all his tastes, but before he created man he made a beautiful garden, and he put man in it to dress and keep it."

HERB GARDENS*

—BY—

MRS. HOLLIS WEBSTER

THERE IS TODAY a keen and growing interest in the revival of the ancient herb garden, in which herbs, herbs, yarbs, or simples, were known to the humble healer before they interested the botanist. The folklore and traditions that surround the herbs are interwoven with the lives of all races. Herbs are happy in almost any home, and thrive even in neglect. Consequently, they have contributed to the most varied types of groupings, from the intricately designed knot gardens of Elizabethan times, with their topiary work, to the present. The Shakespeare garden is the period herb garden most commonly reproduced. The plants that Parkinson talks about in his *Paradisus* are in our nurseries today—thrift, winter savory, lavender-cotton, rosemary, sweet marjoram, bushy thymes, germander, lavender, and many more.

Theophrastus, about 300 B.C., described plants from the garden of his teacher, Aristotle, the Greek. The writings of Horace and Virgil are rich in suggestions as to the herbs which grew in Roman gardens of that era. Much is said of bees and of the herbs that best feed them—mugworts, borages, savory, sages, basils, honeywort (*Cerinth*), nepeta and hyssop. A modern conceit is a bee-room leading through the hedge door into the herb garden.

In “Adam and Eve” gardens, with their wattled fences, the mediaeval reproduction may be enclosed by closely-planted viburnums, with their flexible twigs woven into a leafy wall. The “turf seats” are cushioned with turf, or with soft mats of sweet-smelling herbs—prostrate thymes, chamomile and calamint.

The famous physic gardens, beginning with the monastery gardens of the Middle Ages, furnished materials for the preparation by the monks of remedies of all kinds. Here grew madonna lilies, whose roots with the oil of roses made a healing salve, aconites, belladonna, foxglove, as well as culinary and pot herbs for salad and soup. Such gardens were maintained for their utility, and not until Strabo and Chaucer are there significant allusions to their aesthetic appeal. The attitude of the

*Abstract of lecture given by Mrs. Hollis Webster at the Morris Arboretum on Saturday, February 12, 1938.

Middle Ages seems to be summed up in Charlemagne's reply to the question of his teacher. Alcuin asks, "What is an herb?" Charlemagne replies, "The friend of physician and the praise of cook."

With the returning interest in herbs and the making of herb gardens, this horticultural effort will take on more importance if, from adaptation of the foregoing historic types, we conform to the period architecture near by. Lists of plants compiled from old manuscripts are available, and innumerable treatises tell how to use the herbs. More perennials than those named can find a place. Consider elecampane, yarrow, ground ivy, feverfew, Herb Trinity, aconites, larkspurs, foxgloves, and many, many more.

An abandoned cellar hole may become part of a landscape plan reminiscent of the walled or herb-banked enclosures of Anglo-Saxon times. The side walls will grow wallflowers and bluebells at their best, with crevice herbs—thymes, low chamomiles, Corsican mint between the paving stones. Lavenders from the top of the wall fall in festoons over the edge to meet rosemary bushes below. The floor may be paved, or formally planted with herb beds.

Even small city backyards may harbor herb gardens. In spite of smoke, mother-of-thyme, ground ivy and mint (planted near the drip of the faucet), bugles, *Ajuga reptans*, and the later flowering species, *Ajuga genevensis*, thrive in such places. In spring, besides the narrow central path, bulbous herbs, squills, muscari, chives and narcissus appear, while honeysuckle and English ivy grow on the walls. For lavenders, marjorams and basils there is too little sunlight and fresh air. With study of the soil and a thorough liming once a year, a determined city gardener can make a fragrant as well as useful herb garden.

Window-ledge and porch boxes will supply the apartment dweller with culinary, salad and sweet-leaved things. With morning sun followed by shade, lemon balm, *Melissa officinalis*, Menthas, particularly orange mint, *Mentha piperita* var. *citrata* grow well and are better for frequent culinary cutting. Flowers for such boxes may be had from blue, pink and white hyssops and *Lonas inodora* (yellow). A box of special merit contained heliotrope, fringed lavender, heart's-ease, mignonette and green and purple basils. There was always some bloom. The sweet-leaved geraniums are commended. In out-of-door living rooms, particularly those with stone or paved floors, the usual box, bay and laurel in tubs may be augmented by southernwood

bushes, *Artemisia vulgaris*, rosemary and green santoline bushes. Pruning before transfer to containers holding good calcareous soil, is the only special treatment.

Window gardening with herbs is an age-old custom. Rosemary and marjoram will fill living rooms with fragrance and an atmosphere of gentle living. Ground ivy is interesting in a hanging basket. Fuchias, jasmines, scented geraniums, were with us before the Boston fern and rubber plants. The old "stove plants," pineapple sage, *Salvia rutilans*, and the Righte Dittany, *Origanum Dictamnus*, are here again as tender herbs. Plants change their habits when grown indoors, and fragrance is sometimes reduced. Santoline, marjoram and thyme grow trailing stems, and the orange mint loses the bronze in stem and leaf.

For color in winter windows, a pot of marigolds, the semi-double *Calendula officinalis*, makes sunlight. In a deep window box, chives, tarragon shoots, perennial onion sprouts, sorrel, parsley and chervil do well, if not too crowded. New green tips are cut for garnish, omelette or salad. A wet cloth stretched over a pan of water, sprinkled with seeds of mustard, *Barbarea vulgaris* and pepper grass (*Lepidium sativum*), in two or three weeks will furnish a piquant flavor for sandwich spread. Of course, these annuals, which germinate quickly, must be sown at intervals all winter.

Twelve most important kitchen herbs, in the order of their necessity for the speaker, would be: Rosemary, thyme, marjoram, mints, parsley, chervil, chives, horehound, lavender, burnet, rue and southernwood.

In those old gardens occasionally found near an ancient farmhouse, beside a winding road, may still be found beside the sweet old aromatic herbs, damask and cinnamon roses, bouncing Bet, tiger lilies and sweet rocket, a bush or two of honeysuckle, and lilacs, white and purple. It apparently was planted without design, just patches of herbs with well-trodden paths between them. Here grew perhaps in summer the tender lemon verbena and rose geranium, leaves always ready to use in jelly or cake; sage, savory, thyme and marjoram for soups and spice; lemon balm, mints, chamomile and catnip for teas; santolina, lavender, red bee balm seeds and sweet mugwort to put into sweet bags, and ambrosia and blush roses for the bride's bouquet. Southernwood at the doorstep, sweet woodruff under the syringas, valley lilies and violets running off into grassy edges, and other glimpses fill up a picture of restful simplicity, harmonizing with the soft gray shingles of the old dwelling, under whose shadows it breathes a more formal but gentler civilization.

WATER GARDENING*

—BY—

CHARLES L. TRICKER

WATER GARDENING IS, perhaps, the simplest and easiest of all forms of gardening. After the pool is once planted, none of the laborious tasks of ordinary gardening, such as, weeding, hoeing and watering, take away the joy and satisfaction obtained from the pool. Indeed, it is a simple matter to establish a pool and water garden if one will bear in mind three very simple rules which cover the things necessary for the successful cultivation of aquatics. These three essential things are: sun, water, and good soil.

In all gardening we are likely to be quite successful if we follow the little rules laid out before us by nature and try to duplicate the conditions under which we find things growing wild. Ask yourself the question, "Where did I ever find water lilies growing wild?" and I am sure your answer will be, "Never in shaded places—always out in full exposure to the sun." Another answer will be, "Never in swiftly running water, in fact, not where there is even a perceptible flow of current—always in still and quiet water." Thus, two very essential requirements are easily understood—full exposure to the sun, and still, quiet water.

We might think that soil from swamps would be ideal for aquatic gardening, but such is not the case. It is likely to be too sour or too acid, and would have to be treated for some time before it became fit to use anywhere. It is much better to prepare the soil by using three parts of good top soil or compost, and one part of thoroughly rotted cow manure. Water lily specialists have recently put upon the market a special fertilizer for aquatic gardening under the name of Praefecta. As it is a highly concentrated product, it should be used very sparingly. One part is sufficient for one bushel of soil. While I do not recommend bone meal as a balanced plant food, it is satisfactory to use at the rate of one quart to one bushel of soil, but *never* use either sheep manure or blood meal in preparing the soil. Both are stimulants, and both are quickly spent and likely to create a condition in the pool most unsatisfactory and unsightly.

Water gardening is not necessarily restricted to those with large estates, for one

*Abstract of lecture given at the Morris Arboretum on March 12, 1938, by Mr. Charles L. Tricker.

can get a great deal of satisfaction from a miniature pool. Any receptacle that is at least two feet across and one foot deep can be pressed into service as a miniature pool. A discarded wash tray, an old wash tub, a bath tub, a stock water trough, half of a hardwood barrel—any of these will make suitable miniature pools if made of any material except copper. Never use copper in water gardening. Special tubs designed for the purpose can be obtained at a small cost.

The method of establishing such a pool is to sink the tub almost to the rim in a position well exposed to the sun. Fill the tub half full with soil as already described, cover with one-half inch of clean sand, and fill with water. Do not drain the pool for planting. The purpose of filling before planting is to give the water an opportunity to warm up before planting. Such a receptacle is not large enough for more than one water lily, and a variety should be selected which is marked as being suitable for tub culture, or at least as being of moderate growth. One or two plants usually spoken of as “shallow water” or “bog plants” can be accommodated at the side of the tub or miniature pool. The Umbrella Palm, or even our common Cattails, make ideal subjects for that position. Two or three submerged plants, which perform a most useful function in the pool, may be used. These plants absorb carbon dioxide and throw off oxygen, thus helping to create a balanced condition in the pool. One floating plant, such as a Water Hyacinth, may be introduced into this miniature pool, but one must be careful that it does not crowd out other things.

A bath tub will accommodate twice as much as a tub garden, and would certainly be more enjoyable.

Portable steel pools are also obtainable at attractive prices. One pool measuring 4 feet wide, 7 feet long and 18 inches deep, can be obtained for as low as \$19.50. It comes all assembled ready to install. It will accommodate three times as much as a tub pool.

An artificial pool is, perhaps, the next advanced step in water gardening. Such a pool may be made of any material except copper. However, an excellent pool may be made of ordinary tile set on end, the spaces filled up with concrete, the joints carefully cemented, and the whole inside, after the bottom has been put in, coated with cement. Cement blocks have been used in the same manner. Stone or bricks laid in any material that can be made into a watertight pool will answer the purpose.

It is well to have impressed upon our minds at the very beginning that a lily pool should never be more than 20 to 24 inches deep when completed, for water

lilies are not deep-rooting plants, neither do they enjoy deep water. Ten to twelve inches of water over 10 to 12 inches of soil is ample and, in fact, ideal.

To allow for a six-inch bottom, the excavation need be no more than 26 inches. Ordinarily, artificial pools are of regular shape—either rectangular, round or oval, and with straight sides. In the building of such pools, forms of lumber are required, back of which the concrete is poured. It is so much easier and so much cheaper to make an informal pool that I am sure you will bear with me while I tell you how very simple it is. First, mark out on the surface of the ground the outline of your proposed pool. It can be of any shape to fit into the particular location you select. Begin your excavating in the center, and dig down to a depth of 26 inches, or a trifle more if you desire to have the pool more than 20 inches deep when completed. Continue excavating toward the edge of the proposed pool, but instead of cutting down the edges straight, slope the excavation toward the edge of the pool. The angle of this slope should not be more than 45 degrees, and the excavation when completed will probably resemble a huge saucer sunk in the ground. Tamp down carefully the mixed concrete to a thickness of three inches over the entire excavation. Lay your reinforcing material on top of this concrete, and then complete the job with three inches more of concrete. When completed you will have the entire excavation covered with a 6-inch slab of concrete with the reinforcing material in the middle. The top edge of the pool can be finished with large stones, flat rocks and boulders, so as to give the appearance of a natural rock-bound pool.

Except in very small pools, I always recommend that the lilies be planted in separate containers holding not less than one bushel of soil. These containers may be 18 to 24 inches square and 10 to 12 inches deep, according to the depth of the pool.

If one is so fortunate as to own a meadow property, through which a small stream of water flows, it would be a very simple matter to make a natural pond by building a strong embankment at the lower end of the property, and excavating so as to impound water to a depth not exceeding two feet. In such a place water lilies and other plants can be planted directly in the soil at the bottom.

There are two kinds of water lilies, namely, hardy water lilies and tropical water lilies. The hardy water lilies are all closely related to our native sweet-scented pond lily, and can be obtained in all colors except blue. One characteristic of the

hardy lilies is that the flowers are borne on limp stems floating upon the surface of the water. In the latitude of New York, Cleveland and Chicago, the hardy lilies should not be disturbed until early May. By that time the water conditions ought to be such that they will start into active growth. The tropical water lilies are obtainable in all colors, and the outstanding characteristic is that they are borne on stout stems well above the surface of the water. Furthermore, the tropical lilies produce many more and much larger flowers during the season than the hardy lilies. They should not be planted, however, out of doors in the latitude of New York, Cleveland and Chicago, until the early part of June. They are rapid growers and quickly give results.

For miniature gardens, I can highly recommend in blue the variety Henry Shaw or Dauben, both of which are tropical lilies, as there are no hardy blue lilies.

In hardy lilies the best pink would be either Pink Opal or Marliac Flesh. In yellow, the variety Chromatella adapts itself very nicely to limited quarters, but the variety Yellow Pygmy is indeed most satisfactory. In the autumn shades are Solfatare and Aurora; in white, Marliac White, and in red, Gloriosa.

One must not forget that there are many other plants besides water lilies that can be adapted to pools. The several varieties of Lotus or Nelumbiums are most desirable for pools. Their foliage is unique, and their flowers are astonishingly beautiful and attractive.

The shallow water and bog plants offer a large field of interest. Some of the more common ones are the Arrowheads, Cattails, Hardy Callas, several varieties of Water Iris, the Papyrus, or Egyptian Paper Plant, Parrot Feather, variegated Sweet Flag, and the Umbrella Palms. In floating plants probably the best-known is the Water Hyacinth, but the Shell Flower or Water Lettuce, and the Water Fern, are equally interesting.

The best of the submerged or oxygenating plants is, without question, *Anacharis* (*Elodea*). *Vallisneria* is another very useful plant for this purpose, and *Cabomba* and Milfoil (*Myriophyllum*) are also desirable.

Around artificial pools one can grow many of the moisture-loving perennials, but an abundant supply of moisture should be available for them at all times. However, it might be in keeping with the general design of the garden to work in, in back of the pool, an attractive rock garden.

PLANT DISTRIBUTION

BY THE

MORRIS ARBORETUM, UNIVERSITY OF PENNSYLVANIA

THE PLANTS listed below are ready for distribution to Associates of the Arboretum. All are trees or shrubs, many having distinct ornamental value. The supply in cases is limited. If it can be arranged, Associates are urged to visit the Arboretum and make selections. It is hoped that members may take their plants with them. Plants going beyond the Japanese beetle quarantine must have all soil removed from the roots.

***Amorpha frangans*, Sweet — M1470**

A native deciduous shrub having compound leaves and purple-blue flowers.

***Amorpha fruticosa*, Linn — M5395**

A native species similar to the above.

***Benzoin aestivale*, Ness — M6674**

The native Spice Bush. An upright, slender, deciduous shrub, bearing yellow flowers in spring and scarlet fruits in the autumn.

***Berberis diaphana*, Maxim — M105**

A Chinese deciduous and spiny shrub having red fruits.

***Berberis Bretschneideri*, Rehd. — M5401**

A Japanese species — A tall, wide-spreading shrub having purple fruits.

***Berberis dictyophylla*, Franch. — M4248**

A Chinese species obtained from the Rock Expedition bearing red fruits.

***Berberis* — R-23339 — M4253**

An unidentified Chinese Rock Expedition species raised from seed.

***Berberis emarginata serrata*, Schneid. — M5409**

A low-growing species having red fruits.

***Berberis Silva-Taroucana*, Schneid. — M4250**

Another Chinese species from the Rock Expedition bearing scarlet fruits.

***Berberis Wilsonae subcaulialata*, Schneid. — M6815**

Deciduous or half-hardy shrub of Chinese origin.

***Berberis yunnanensis*, Franch. — M4251**

This Chinese species was also obtained from the Rock Expedition collection.

***Buxus sempervirens suffruticosa*, Linn. — M376 and 377**

An evergreen ornamental shrub known as "Edging Box."

Buxus sempervirens Handsworthii, K. Koch — M357

An upright form having larger dark-green leaves.

Chamaecyparis pisifera plumosa aurea, Beiss. — M1455

A golden-tipped variety of the Japanese Sewara Cypress having graceful plume-like foliage.

Chamaecyparis pisifera squarrosa, Beiss. — M1127

A glaucous, blue-green color form of the Sewara Cypress.

Celtis occidentalis, Linn. — M4624

A native deciduous tree, known as the Hackberry. Bears orange-red to dark-purple fruits.

Cornus alba, Linn. — M5389

A deciduous shrub having showy bright-red branches and bluish-white fruits. A Siberian and North China species.

Cotoneaster acutifolia, Turcz. — M5432-5435

A slender, spreading, deciduous shrub producing pale pink flowers and small black fruits. A native of China.

Cotoneaster acutifolia villosula, Rehd. & Wils. — M5431

Similar to the above species. From Central and Western China.

Cotoneaster horizontalis, Decne. — M4466-5443

Half-evergreen, low-spreading shrub bearing pinkish flowers and bright-red fruits. A western China species.

Forsythia suspensa Fortunei, Rehd. — M598

Vigorous growing, upright form, with the arching branches of the well-known Golden Bell.

Hypericum densiflorum, Pursh. — M4573

A small, upright, native, deciduous shrub bearing a profusion of small yellow flowers.

Hypericum patulum, Thunb. — M4408 and 4495

Half-evergreen, low-spreading shrub having an abundance of golden-yellow flowers. A Japanese species.

Hypericum prolificum, Linn. — M4496

Small deciduous shrub having upright branches and bright yellow flowers. A native species.

Ilex verticillata, Gray — M5466

A native, deciduous, spreading shrub valued chiefly for the decorative bright-red fruits. One of our finest berried plants.

Lonicera notha carnea-rosea — M4910 — Bush Honeysuckle

A deciduous, spreading, flowering and fruiting shrub of horticultural origin.

Lonicera Ruprechtiana, Reg. — M4513

A Chinese species of upright form, producing coral or orange-red fruits.

***Lonicera tatarica alba*, Loisel — M4916**

A medium-size variety having pure white flowers and red fruits.

***Lonicera tatarica rosea alba*, Regel — M4914**

Similar to the above, but having rosy-pink flowers.

***Lonicera tatarica Leroyana*, Rehd. — M4919**

A more compact form producing pink flowers.

***Lonicera xylosteum*, L. — M2345**

A European species having yellowish-white flowers and dark red fruits.

***Malus pumila Niedzwetzkana*, Schneid. — M1735**

An interesting and useful crab-apple of large size, good flavor and the flesh of the fruit red throughout. One-year-old grafted scions from the Arboretum specimen. Of South-western Siberian and Turkestan origin.

***Neillia sinensis*, Oliv. — M469**

A graceful, slender branching low shrub bearing pink flowers. Suckers well, thus forming dense clumps. A Central China species.

***Rhamnus infectoria*, L. — M5513**

A spreading, deciduous shrub of European origin.

***Rhododendron japonicum suringar* x *R. molle*, G. Don — M5520 (*Azalea molle* hybrids) hort.**

Erect-growing, deciduous shrubs having large, conspicuous flowers ranging in color from yellow to salmon-red.

***Rhodotypus scandens*, Mak. — M4549**

A spreading, deciduous shrub having large white flowers followed by black fruits. Native of China and Japan.

***Salix purpurea amplexicaulis*, Boiss. — M528**

A variety of the Purple Osier. A low-branching and spreading shrub willow from Southeastern Europe and Western Asia.

***Securinega ramiflora*, Muell. — M4703**

A medium-size, deciduous shrub having slender, spreading branches, of graceful form. An ideal specimen plant for the lawn. Asiatic origin.

***Spiraea alba*, Dur. — M5966**

A native, upright, deciduous flowering shrub of decorative value.

***Spiraea Billiardii*, Herincq.**

A free flowering hybrid producing dense panicles of bright rose flowers.

***Spiraea Lenneana* — M5907**

Similar to the above.

***Spiraea myrtilloides*, Rehd. — M5796**

A slender spreading shrub bearing a profusion of white flowers. A Western China species.

Spiraea pseudo-Douglasii — M5912

A closely-related form of the beautiful deep-rose flowering Douglasii.

Spiraea salicifolia x S. superba — M5916 and 5917

An interesting hybrid between a plant having pinkish-rose colored flowers and a European and Asiatic species having rose-colored flowers.

Spiraea sanssouciana, K. Koch — M5918

Another hybrid between the garden variety Douglasii and a true Japanese species of upright habit and floral beauty.

Symphoricarpus albus laevigatus, Blake — M4556

A native variety of the Snowberry, but having larger fruits. Dwarf deciduous shrubs valued for their attractive fruits.

Symphoricarpus orbiculatus elongatus, Hort. — M5920

A varietal form of the Indian Currant, having small red fruits.

Staphylea pinnata, L. — M4552

An upright, deciduous shrub having greenish-white flowers followed by inflated fruits. The European Bladdernut.

Thuja occidentalis vervaeneana, Gord. — M2563

A varietal form of the American Arbor-vitae—smaller than the species.

Viburnum dilatatum, Thunb. — M5546A.

A Japanese upright deciduous shrub having scarlet berries.



FINAL WINTER LECTURE

THE LECTURE COURSE at the Morris Arboretum for the 1938 season dealt with plants in various types of ornamental groupings. The speakers were well-known authorities in their several lines.

April 9, 1938

MR. ROBERT S. STURTEVANT

Beds and Borders

Mr. Robert S. Sturtevant, of Groton, Massachusetts, a well-known landscape architect, will speak on Beds and Borders, covering perhaps the more usual types of planned ornamental groupings.

The lecture will be given in the auditorium of the Morris Arboretum, at Chestnut Hill, on the second Saturday of April, at 2:30 o'clock. Admission is free, and cars may be parked opposite the entrance on Meadowbrook Lane.

HERBARIUM ACCESSIONS OF WOODY PLANTS DURING 1937

BY GIFT

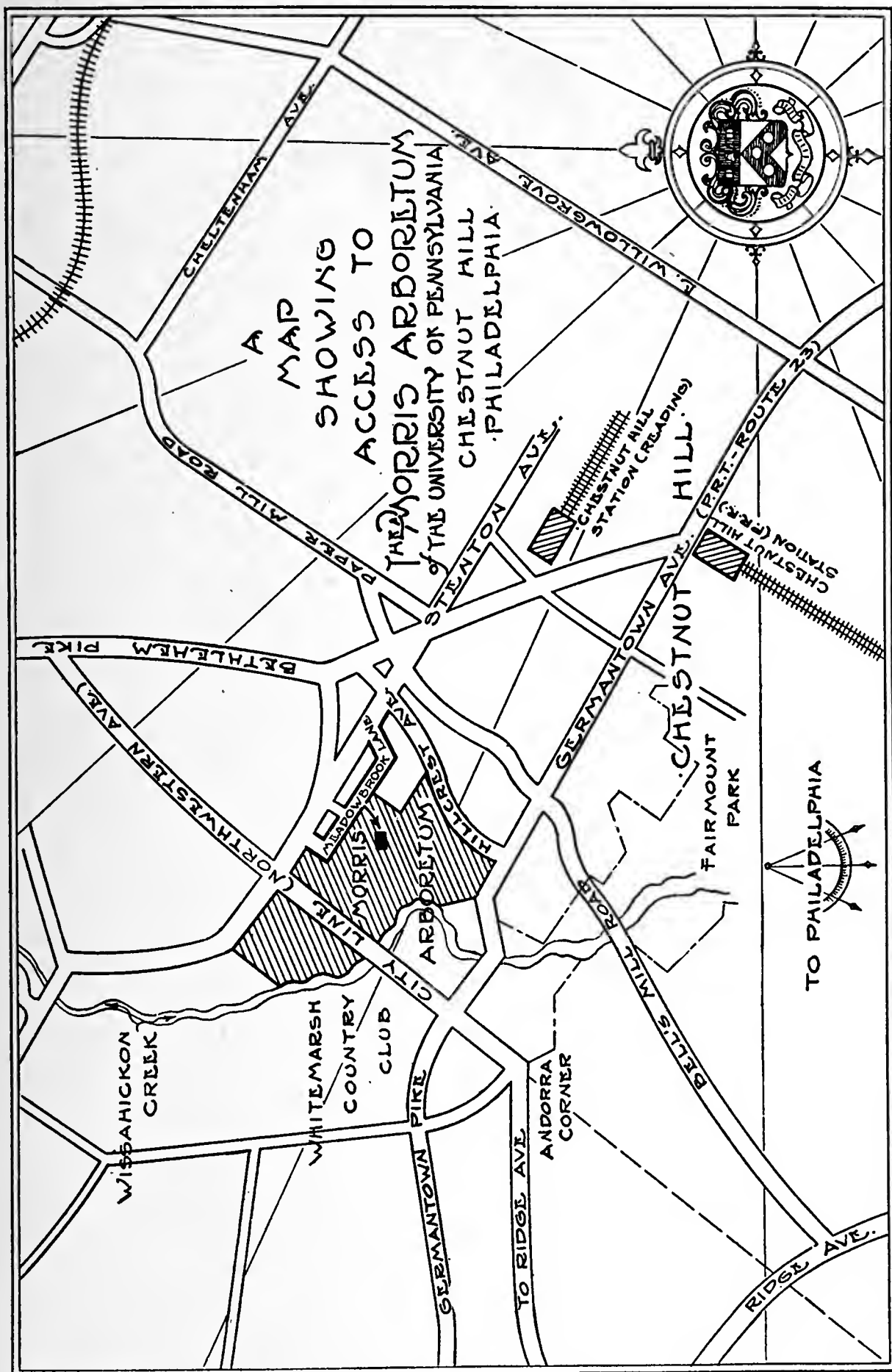
Adams, J. W.—From New Jersey and Pennsylvania	794
Adams, J. W. & Myrtle T.—From Pennsylvania	39
Adams, J. W. & Wherry, Edgar T.—From Maryland	58
Bickford, Ruth—From Texas and California	3
Brubaker, Ethel—From Lancaster County, Penna.	102
Deam, C. C.—From Indiana	5
Dornan, J.—From North Carolina	6
Fender, Flora S.—From New Jersey and Pennsylvania	109
Fogg, John M., Jr.—From New Jersey, Penna. and Virginia	285
Fosberg, F. R.—From Hawaiian Islands and New Jersey	32
Glowenke, Stanley L.—From Northeastern Pennsylvania	12
Koster, Hollis—Oaks from New Jersey	3
Lambert, James and Bertha—From United States and Canada	31
Langman, Ida K.—From Monroe County, Penna.	31
Neal, Oliver M., Jr.—From Maine	4
Smith, Katherine G.—From New Jersey	8
Travis, Mildred T.—From Pennsylvania	6
True, Rodney H.—From Maine, New Jersey, Penna. and Maryland	41
Wagner, Paul R.—From Schuylkill County, Penna.	118
Wherry, Edgar T.—From Western United States (Mostly woody phlox)	352
Wherry, Edgar T. & Fender, Flora S.—From New Jersey	6

BY EXCHANGE

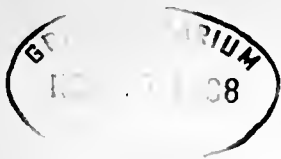
Bailey Hortorium, Cornell University—From Africa, etc.	70
McFarlin, J. B.—From Florida	229
Missouri Botanical Garden, St. Louis, Mo.—From Western United States	50
New York State College of Agriculture, Cornell University—From New York State	346
Purer, Edith M.—From California	18
Rutgers University, New Brunswick, N. J.—From Jamaica and New Jersey	84
University of Montreal, Montreal, Canada—From Canada	199
University of Pennsylvania—For herbaceous plants	136
TOTAL	3,177

On March 15, 1938, the grand total of mounted and distributed specimens in the Herbarium was 19,548.

J. W. ADAMS

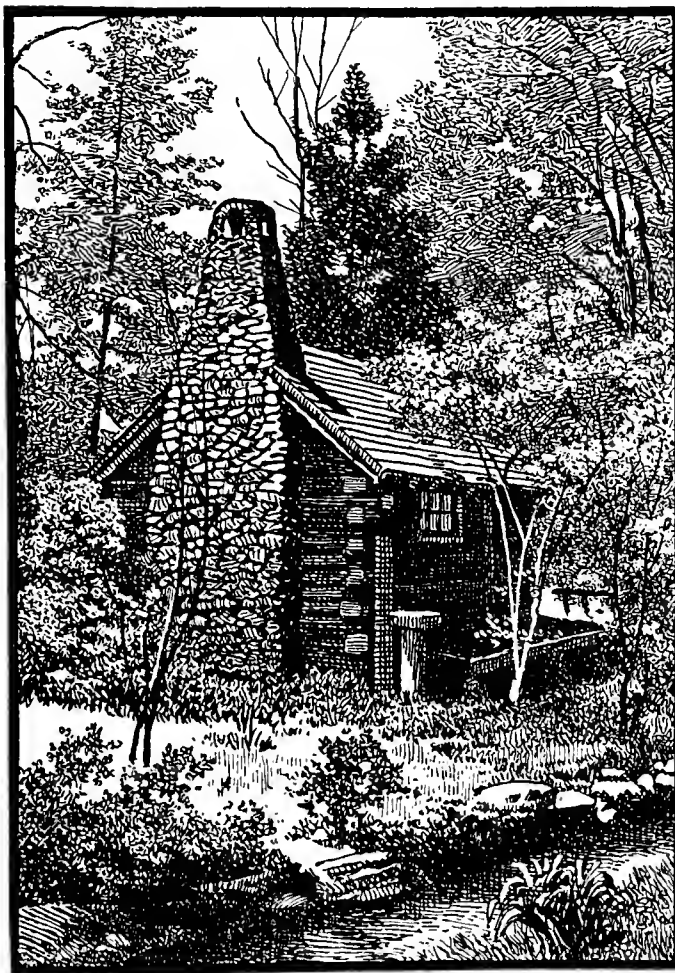


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ARBORETUM BULLETIN
OF THE
ASSOCIATES

JULY, 1938



THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

Set
US²
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VOL. 2 No. 12

MORRIS ARBORETUM
CHESTNUT HILL
PHILADELPHIA, PA., U.S.A.

Set
US²

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THE
MORRIS ARBORETUM
OF THE
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Pinus Bungeana Zucc.
Lace-bark Pine

ARBORETUM BULLETIN, JULY, 1938

The Lace-bark Pine, *Pinus Bungeana* Zucc., is a tree of Northwestern China, introduced into America in 1846 (Rehder). It is a slow-growing tree, branching at the base, with sparse, light-green foliage, and sheds its outer bark in patches, much like the sycamore, thus giving to the stem and larger branches a strikingly mottled appearance. This appearance doubtless accounts for the name of the tree.

In spite of its shrub-like habit, the tree reaches a height of 75 feet or more. The stiff, light-green leaves in groups of three are from $2\frac{1}{2}$ to 5 inches long. The cones, almost without stalk, are from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches long, with the scales that make it up tipped by a spine with a broad base.

This hardy species, by its thin foliage, branching habit and spotted bark, contributes a very characteristic element to a planting.

The tree photographed for this illustration stands near the Rose Garden in the Arboretum.

The cover drawing represents the log cabin by the Chestnut Hill brook.

The photograph and the drawing were made by Gustave Liebscher.

RODNEY H. TRUE

FLOWER BEDS AND BORDERS*

—BY—

R. S. STURTEVANT, M. L. A.

FLOWER BEDS AND BORDERS which with their boundary paths or panels of green-sward form the pattern of any garden occupy in a way the left-over areas. Some we may call beds, bounded on all sides by paths; others, borders, the space between a recognizable path and the garden enclosure of wall or hedge. Each has its place in the garden design, and few gardens without a border planting where we can use color directly against a background are completely satisfactory. A bed must be seen to a greater or lesser extent from all sides, whereas, the border is really seen from but one long side.

The design of the garden as a whole indicates the relative importance of this bed or that, their importance diminishing quite markedly as they lie farther away from a major axis or garden feature. Hence, it follows that the enclosing borders, if to be seen across a pattern of plants and paths, are relatively unimportant in their arrangement of detailed planting. In fact, many a garden gains interest by carefully balanced and selected plantings in the central beds and a riot of variety in the borders. Only when a garden is a mere panel of grass enclosed by flowers do the borders require touches of formality in their planning. Then, too, the end border opposite our usual entrance counts enormously and deserves special consideration to secure the greatest possible interest of color, form and texture in each season.

The very fact that locations about a terrace or central pool, or to either side of a main axis, are both the first and the most seen, we must not only select plants of continuing interest, but place them meticulously. We need succession of interest in color or foliage, and we cannot afford breaks due to the dying down of a plant like the Oriental poppy, or eyesores so conspicuous as the heavy foliage of yellowing Trumpet daffodils. Just as the Flowering Dogwood among trees rates high for its habit of branching and charm of winter bud, its spring white and summer green and autumn crimson, so some flowers, *or*, under cultivation, some combinations of flowers, rate highly.

And without speaking of color schemes or patterns, let us consider growth habits, both above and below ground, and their effect on a close planting. And it should never be forgotten that we must have close planting to secure any appreciable

*Abstract of lecture given at the Morris Arboretum on April 9, 1938.

succession of bloom. The English axiom—a plant to every six-inch square—suggests the ideal, but in an established border many a spadeful of some plants will provide us with a dozen or more divisions for a new planting.

Nature provides our pattern. Perhaps a widespread oak shelters a scattering of Judas tree and Dogwood. Below this canopy a carpet of brakes or low bush blueberries may vie for light. In the fall there may be scattered clumps of woodland asters or goldenrod, in spring colonies of violets. Above ground we have superimposed layers of foliage and below ground, if we but knew it, we have shallow and deep-rooting layers. We have plants that are in active growth at different seasons. We can remove and restrain the less effective natives, insert shade-loving lilies, scatter shallow-rooting scillas to join the violets, tend sheets of equally shallow-rooting *Phlox divaricata*, and drift in sweeps of the *Incomparabilis* daffodils, which better endure the well-drained soil that our sheltering oak has indicated as the natural soil. Naturally, in a well-prepared garden bed in a sunny spot our problem is different, but we must study the root habits of its occupants, as well as their colors and heights. If we crowd plants of the same kind or habit, we must make up for it by extra feeding, extra care in pruning and thinning, BUT if we crowd plants (as in nature) of varying habit, we may approach our much-sought ideal of succession of interest with relatively little maintenance.

A dense, compact root system of any depth prevents interplanting. *Hemerocallis*, *Hosta*, Beardless Irises, Phlox, the bigger Veronicas, and, to a fair extent, Peonies and *Fraxinella*, *Bocconia* and *Silphium*, to mention but a few, should be used singly or in a single line where their foliage will add to the composition when the flowers have gone by. Only the most enduring of groundcovers will creep close to their dense crown, and only an occasional Tiger Lily, or something of the sort, will find its way through their wall of root and foliage. So many of the Daisy family are both shallow-rooting and husky that we may let them run as chickens do in the country hog pen if they enhance our effect. Other *compositae*, however, like chrysanthemums and some hybrid asters, need annual replanting, and their shallow rooting may suggest their use over deep-rooting bulbs, for there are shallow-rooting bulbs like *Scilla sibirica*, *Eranthis*, or *Corydalis*; deeper-rooting bulbs like tulips and hyacinths; and still deeper-rooting narcissus and lilies or trilliums and erythroniums, which are so difficult to collect from the wild.

With well-prepared beds and borders, what we then need is intelligent planting and supervision, but not the time-honoured cultivation of custom. If you are growing vegetables or exhibition flowers, plant them in rows and cultivate for perfection, but for effect let your plants grow together. Restrain this or that as needed, but as

spring passes into summer let no bare ground show in your borders. Out-of-place weeds or *Boltonia* can be yanked out by the roots, dead flowers removed and broken stalks restaked (if the stakes are inconspicuous. I sometimes wonder whether it is the lilies or the stakes that I am expected to admire). Even in earliest spring don't hoe all the baby seedlings or rake out all the trailing sedums and pinks. Think of the proud purchaser of the new Korean chrysanthemums who saw the bloom, but whose gardener hoed so close to the blooming stalk that there was no natural increase.

Space does not permit much mention of design, the value of properly placed accents of evergreen or foliage, the charm of dot plants to break the flatness of small beds where early bulbs in mass give way to annuals, the way that a straight line of phlox may echo the line of the bed itself, or a curving line of irises distract therefrom and lead the eye insensibly up the height of a standard lilac. There is little chance to enumerate tricks of maintenance like breaking forward tall aster sprays to fill the oasis left by the Oriental poppy, or the planting of an erect, clumpy columbine that will permit a carpet of low phlox to remain unsmothered at its feet. Each writer, each practitioner, each gardener, has his own ways. Each can learn to advantage and no one system, either on paper or in planting, really suits all the beds and borders in even one garden.

Generally speaking, a bed should be of workable size, not over six feet in width (it may be a foot wide ribbon as part of a paved pattern). Speaking generally again, this width rarely permits the use of many plants much higher than a phlox or peony, and a wider bed which permits greater heights in its occupants really becomes two borders backed against each other—a not undesirable solution in many a garden. On the other hand, a border with its proper background, can hardly be less than six feet in width with any satisfaction in its planting, although its width should, in section, be related to the height of hedge or wall behind. A low hedge permits a view over, and a four- to five-foot border carries needed height. A six-foot wall sets off all but the tallest of flowers and a still higher one, as in so many of the English borders, permits the use of small trees and shrubs to great advantage. Incidentally, a flower border should make use of any plant material that adds to its effect, and not be limited to the use of herbaceous material only. There are too many garden sites that need the winter interest of accents or edgings of twig or berry or evergreen.

And in this most fascinating of pursuits, the growing of flowers in beds or borders, remember, that despite all your care and expense in preparation, every garden has a different place in the design. It has different exposure, soil, drainage, climate,—one knows not what,—but each of us cannot blindly copy someone else's treasured effect with success, but may well come upon one of our own.

THE HORTICULTURAL VALUE OF NATIVE VIBURNUMS

TO ANYONE with an eye open to the good qualities of our native shrubbery, it most often seem that much beauty is being overlooked. Among these unappreciated plants I would include several species of our own native Viburnums. Anyone who has seen fall come in New England has had pleasure in the changes of color in fruit and in foliage, and has enjoyed flowers in spring or summer as well. The species mentioned below seem to me to be worthy of attention by plant lovers in this part of the country.

Viburnum alnifolium Marsh.

This shrub goes under a variety of common names—American wayfaring tree, the Hobble bush, Witch hobble, and Moosewood being among the number. It will be found from the northeastern states to the higher parts of Pennsylvania, where it occurs in open places in the woods and along the moist roadsides. It has a somewhat spreading, reclining habit, and sometimes roots when the branches touch the soil. Along roadsides it shows its large, rounded leaves, with sharp tips and heart-shaped bases, and with finely toothed margins. The veins on the back are somewhat scurfy.

The compact, five-rayed flower cluster appears in May and June, with two types of white flowers, some of those at the edge of the cyme being much larger than the others. In the fall, the flower cluster is succeeded by flat-topped clusters of coral-red berries that lend brilliant colors to the landscape before they reach the purple-black color of maturity. The foliage alone is a very beautiful addition to the fall landscape. Long before frost, the large, heart-shaped leaves begin to take on a deep wine color that gradually fills the whole top, making its special contribution to the autumn pattern of beauty.

The northern distribution of this species would seem to insure it against winter injury. It is interesting to note that the winter buds are not covered by the usual type of bud scales, but rather by small, rusty outer leaves.

Viburnum cassinoides.

This is another species of great beauty, known under the common names of Withe Rod, Appalachian Tea and Wild Raisin. It also is a type abundant in the northeastern states and along the mountains to the southward as far as North Carolina. It occurs in acid sphagnum swamps and in sandy roadsides and open places. The leaves in general look like those of the Mountain Laurel.

The erect shrub or small tree reaches a height of from 4 to 10 feet, the bark of the young wood being somewhat scurfy. The thick, dull-green deciduous leaves are

from 1 to 3 inches in length. Aside from the foliage, the flat-topped clusters of white flowers are of interest in the summer. The clusters of berries, ripening in the early fall, give this plant an almost unique beauty. Along the moister forest roadsides of New England, the clusters of berries show transitions of color from green to ivory-white, flushing with pink that later intensifies to red on its way to the purples and blues of the ripe fruits. The wide adaptation of this shrub to varieties of soil and moisture conditions, with its ability to withstand stern weather, should give it a place in our shrub plantings.

Viburnum trilobum Marsh.

The taller high-bush Cranberry of wider distribution in the northern states is another hardy plant, already somewhat used in the form of the conspicuous type with showy white marginal flowers that recall the fuller European type known as the Snow-ball tree. The three-lobed, bright-green leaves, the broad-spreading, flat-topped cymes of white flowers, followed by the bright-red acid berries having the flavor of cranberries, make the tall shrub attractive until the late autumn and winter. The fruits are edible. This plant occurs at the edge of the woods, along roadsides, and near streams, where it adds a characteristic lightness to the landscape.

Among the taller members of the Viburnum or Arrow-wood group are two that look much alike to the hasty glance: *Viburnum lentago*, going by several common names—Sheep berry, Wild Raisin Nanny berry, and Sweet Viburnum—among others, and *Viburnum prunifolium*, the Black Haw. They occur naturally as tall shrubs or small trees from New England southward. They may be seen at the edge of woods, along fence rows, and in moist, well-lighted places.

The leaves vary somewhat in shape and in serration. The flat white flower clusters, reaching a size of from 4 to 5 inches across, are seen in late spring and early autumn. They are succeeded by bluish-black fruit clusters that remain until spring unless eaten by birds or animals. The haws have a rather sweetish, raisin-like taste. These species are hardy in this climate.

Viburnum acerifolium. L.

Dockmackie or Maple-leaved Viburnum is a more delicate, slender, upright shrub of the northern range, where it is characteristically found in the not too dense shade of moist woods. It reaches a height of from 4 to 5 feet, and bears foliage resembling the maples, coarsely dentate, three-lobed, from 3 to 5 inches long. The foliage in fall takes on a dark purple color, and the berries are almost black. It is hardy, and in its tolerance of shade contributes a useful quality to shrubbery plantings.

Viburnum scabrellum. Chapm.

This is a species of somewhat more southerly distribution, and is seen abundantly on the highlands along the Delaware River and farther south to Texas and

Florida. The reddish-brown shrub, with a star-shaped pubescence, bears leaves of a rounded outline, having a heart-shaped base, with a coarse-toothed margin.

The flower cluster, of white flowers, is followed by fruits that run through a series of blue colors as they ripen that is rather characteristic.

The shrub reaches a height of from 5 to 6 feet. It grows near open, fairly moist roadsides, where it often forms rather attractive thickets with the hazel bushes, wild grapes and bittersweet.

RODNEY H. TRUE



THE MICHAUX MEMORIAL GROVE

IT MAY NOT be known to many that a memorial grove of oaks was planted in the Fairmount Park at Philadelphia at the time of the opening of the Centennial Exposition in 1876 to commemorate the achievement of a noted French botanist, who, with his even more illustrious father, contributed greatly to the knowledge of the plant life of young America.

On October 1, 1785, André Michaux and his fifteen-year-old son, François André, landed in New York, and immediately set about establishing a nursery in which trees were to be grown for transfer to France, for the purpose of enriching the timber resources of that country. Years passed and rich collections of plants were sent to France, including over 60,000 young trees. These trees were largely dispersed among court favorites, and failed to accomplish the desired results.

The French Revolution came and went. The father, André Michaux, then headed a new undertaking, this time in Madagascar, where he died. His son, François André Michaux, was sent back to America, under the new government, again to explore the resources of the New World and to secure trees for France. This time he had better success. About 250,000 trees were developed from seed that he sent home, and many young trees were successfully transplanted. He secured the publication of his father's great works on American oaks and on the flora of North America, and later added his own account of the forest trees of North America in three volumes. He returned to France while still young enough to see his venture through to a successful issue. He continued his American friendships and contacts with men of science, and was elected a member of the American Philosophical Society and an honorary member of the Philadelphia Society for Promoting Agriculture. On October 23, 1855, "after a busy day among his American trees," he was carried off by a stroke of apoplexy. He left a will with Isaac Lea, of the American Philosophical Society, by which he gave a fund to the Society, to be spent in forwarding work in that organization along the lines of forestry, agriculture and botany. One of the first expenditures from that fund was devoted to establishing a

nursery of many species of oak. These oaks were transferred from the nursery in 1876 to a situation near Horticultural Hall, when Fairmount Park was in the earliest stages of its formation, and should perhaps be regarded as the beginning of that now famous tree collection that in time grew up around the Centennial Buildings.

Through the kindness of Mr. S. N. Baxter, the present Arboriculturist of Fairmount Park, the supposed site of the Michaux Memorial Grove of oaks was located from old maps. A survey showed that the oaks are still there, the group being traversed by Michaux Avenue. To establish still more definitely the identity of this grove, trees were selected by Mr. Baxter as a sample of the supposed memorial group, and through the kindness of Mr. R. D. Forbes, of the Allegheny Forest Experiment Station, and his associates, tests were made with an increment borer to ascertain the number of rings, therefore the ages of the trees in question. Out of the seven tested, six showed an age of sixty years. From the uniformity of age, it seems clear that the Michaux Grove is still made up in large part of the trees planted at the inauguration of the Centennial in 1876. Few replacements seem to have taken place. The trees in general are in good condition and, as things go with oaks hereabouts, are in their vigorous youth. Large oaks dying in the Morris Arboretum have shown from 263 to over 350 rings. If this be the natural life expectation of oaks in this vicinity, many generations of men still to be born will see Michaux's Memorial Grove. Will they know what they are seeing? Perhaps a permanent marker might be in order.

RODNEY H. TRUE



THE EARLY DAYS OF THE SECKEL PEAR

MANY OF US have known the small, rich pear that ripens in the fall with a flavor of its own, known as the Seckel Pear, but have not known that it is of American, indeed of Philadelphian, origin. In searching for the early story of this superior fruit, in answer to a recent request for information on the subject, the writer found an account that should interest Philadelphians. This account was written by that early distinguished horticultural writer and landscape designer, Andrew Jackson Downing, the story of whose life and that of his heroic end lend an added interest to his many writings.

In his book on "FRUITS AND FRUIT TREES OF AMERICA," published in 1852, Downing tells the story of the early days of the Seckel pear. I quote the account given on page 415 of the work cited:

"The Seckel Pear originated on the farm of Mr. Seckel, about four miles from Philadelphia. It was sent to Europe by the late Dr. Hosack, in 1819, and the fruit was pronounced by the London Horticultural Society as exceeding in flavor the richest of their autumn pears."

In the following footnote, the story is amplified:

"The precise origin of the Seckel Pear is unknown. The first pomologists of Europe have pronounced that it is entirely distinct from any European variety, and its affinity to the Rousselet, a well-known German pear, leads to the supposition that the seeds of the latter pear, having been brought here by some of the Germans settling near Philadelphia, by chance produced this superior seedling. However that may be, the following *morceau* of its history may be relied on as authentic, it being related by the late venerable Bishop White, whose tenacity of memory is well known.

"About eighty years ago (1772 ca), when the Bishop was a lad, there was a well-known sportsman and cattle dealer in Philadelphia, who was familiarly known as 'Dutch Jacob.' Every year, early in the autumn, on returning from his shooting excursions, Dutch Jacob regaled his neighbors with pears of an unusually delicious flavor, the secret of whose place of growth, however, he would never satisfy their curiosity by divulging. At length, the Holland Land Company, owning a considerable tract south of the City, disposed of it in parcels, and Dutch Jacob then secured the ground on which his favorite pear tree stood, a fine strip of land near the Delaware. Not long afterward, it became the farm of a Mr. Seckel, who introduced this remarkable fruit to public notice, and it received his name. Afterward, the property was added to the vast estate of the late Stephen Girard. The original tree still exists (or did a few years ago), vigorous and fruitful. Specimens of its pears were, quite lately, exhibited at the annual shows of the Pennsylvania Horticultural Society."

Pictures of the tree in its old age appear in Bailey's Standard Cyclopedia of Horticulture, Vol. III, p. 2513. In 1880, it is shown as a rather decrepit, but still living tree. In 1908, it was represented as a stump, apparently lifeless.

RODNEY H. TRUE



EXHIBIT AT THE PHILADELPHIA FLOWER SHOW AND AT THE ANNUAL MEETING of the GARDEN CLUB OF AMERICA

AT THE INVITATION of the Pennsylvania Horticultural Society, the Arboretum made an exhibit at the Annual Philadelphia Flower Show of a collection of non-hardy, cone-bearing evergreens, mainly from greenhouse material at the Arboretum, presented some years ago by Colonel Robert H. Montgomery. The plants were arranged by James Lambert and John Tonkin, of the Arboretum staff. The graceful

forms of the small trees, with the variety of colors, gave an unusual note to this exhibit that called forth much favorable comment.

This commendation perhaps led the Horticultural Committee of The Garden Club of America to ask that this collection be again shown at its exhibit held on May 11, 1938, at the Franklin Institute.

The Director gave a brief talk on the exhibit and on the work of the Morris Arboretum.

A list of the species and varieties exhibited follows:

TENDER CONIFERS

Araucaria Bidwellii
Araucaria araucana—Monkey Puzzle Tree
Araucaria excelsa—Norfolk Island Pine
Cryptomeria japonica, *vilmoriana*
Cryptomeria japonica, *araucarioides*
Cryptomeria japonica, *nana*
Cryptomeria japonica, Bendai Sugi
Cryptomeria elegans
Cupressus sempervirens
Cupressus sempervirens stricta—Italian Cypress
Cupressus lusitanica
Cupressus Cashmeriana—Cashmerian Cypress
Cupressus tortulosa majestica
Cupressus arizonica
Cupressus arizonica Benita
Podocarpus latifolia
Podocarpus latifolia "male plant"
Podocarpus macrophylla
Podocarpus macrophylla maki (variegated form)
Podocarpus gracilior
Podocarpus acutifolia
Podocarpus ferruginea
Podocarpus dacrydioides
Podocarpus totaro Hallii
Chamaecyparis Lawsoniana Pottensii
Weddringtonia Schwartzii
Libocedrus macrolepis
Libocedrus cupressoides
Libocedrus decurrens
Libocedrus decurrens aurea
Libocedrus plumosa
Taiwania cryptomerioides
Cephalotaxus Fortunei—semi-hardy
Cunninghamia lanceolata—semi-hardy
Sageochea conspicua
Sequoia sempervirens—California Redwood

HARDY CONIFERS

Hardy Conifers included in this group for foreground and background effect were:

Foreground

Juniperus horizontalis
Juniperus sabina tamariscifolia
Juniperus chinensis
Juniperus chinensis argentifolia
Picea conica
Thuja occidentalis Ohlendorffii

Background

Tsuga caroliniana—Carolina Hemlock
Tsuga canadensis Fremdi
Tsuga canadensis macrophylla
Cryptomeria japonica Lobbii—Japanese Temple Tree
Chamaecyparis Lawsoniana—Lawson's Cypress



GARDEN NEWS

The May Day Play by the women students of the University, with the Crowning of the Queen, was held on Saturday, May 14th, at the Arboretum. Rain drove the players and a large audience into the Mansion, where a somewhat modified program was successfully carried out.

The annual meeting of the Women's Alumnae Society of the University of Pennsylvania was held on the open porch of the Mansion on Saturday, May 14th. The annual business meeting followed a box luncheon held in the Mansion because of the rain.

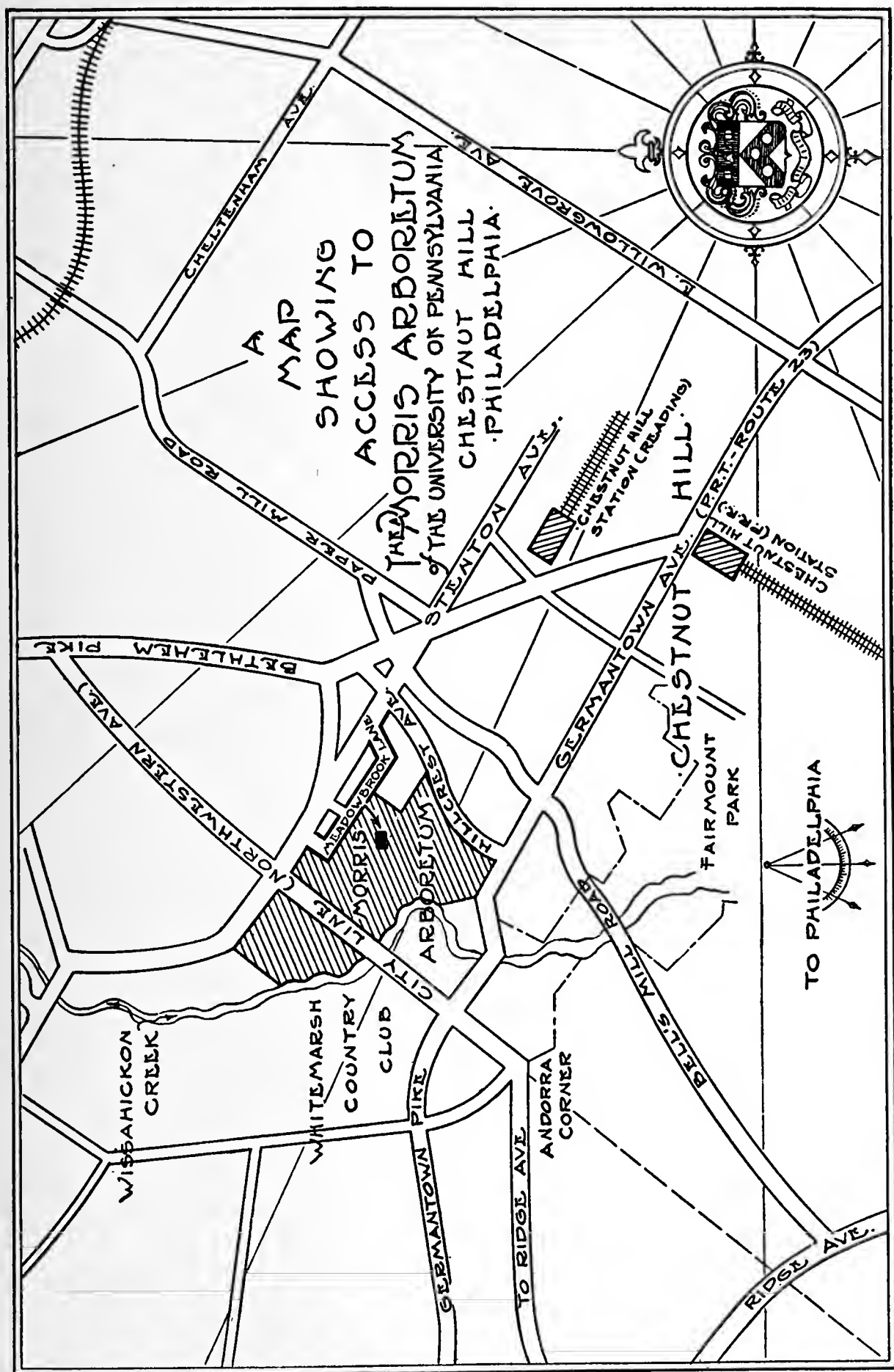
On Saturday, April 23rd, fifty members of the American Philosophical Society, then in session in the City, visited the Arboretum and enjoyed a tour of the grounds.

An educational organization, Pi Lambda Theta, connected with the School of Education of the University of Pennsylvania, visited the Arboretum on Thursday, June 9th, and enjoyed a picnic supper at the Farm.

Classes from the Oak Lane Country Day School, connected with Temple University, have paid the Arboretum two visits.

A group of students from the Lawrenceville School at Lawrenceville, New Jersey, led by Dr. A. R. Evans, spent a part of May 25th at the Arboretum.

The usual visit to the Arboretum by students in the Summer School at the University was scheduled for July 5th.



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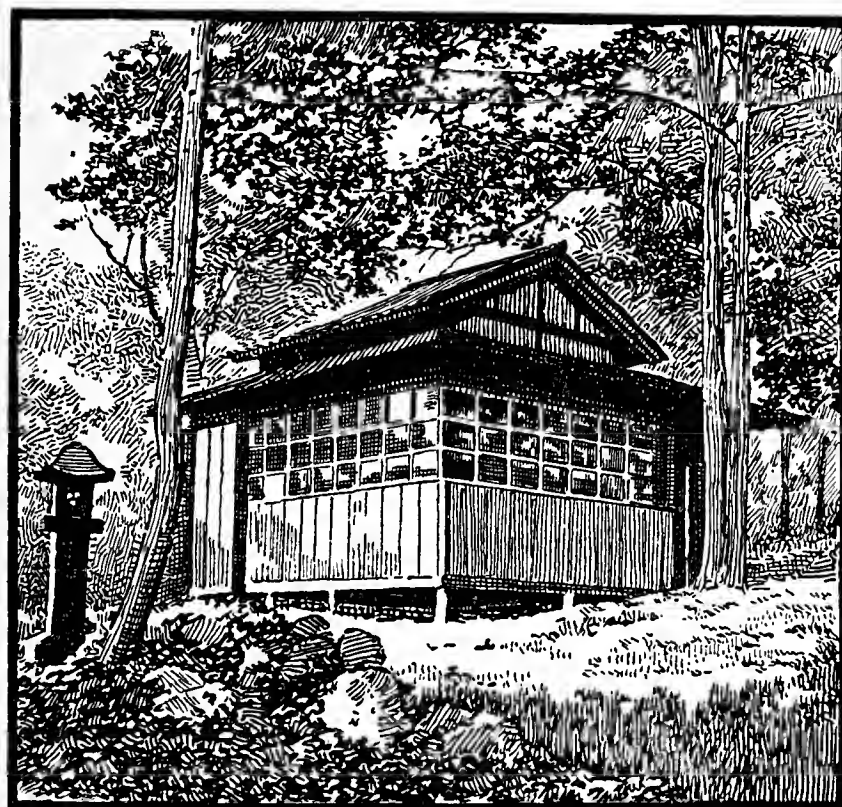
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ARBORETUM BULLETIN
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OCTOBER, 1938



THE
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OF THE
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Sciadopytis verticillata Sieb. and Zucc.
Japanese Umbrella Pine

ARBORETUM BULLETIN, OCTOBER, 1938

The Umbrella-Pine, *Sciadopytis verticillata* Sieb. & Zucc., is a native of Central China that was introduced into the United States in 1861 (Rehder). It is an evergreen tree with a regular pyramidal top that may reach a height of 100 feet, and a trunk girth of nine feet. It bears its large, dark-green, needle-like leaves in brush-like whorls that remotely suggest spread umbrellas. The leaves vary from 15 to 35 in a whorl, are straight, stiff, obtuse and glossy, and from three to six inches long. The ovate-oblong cones are from 3 to 5 inches in length, bearing seeds about one-half inch long.

The tree is hardy as far north as Portland, Maine. It is a strikingly ornamental tree in many Philadelphia estates.

The tree photographed for the frontispiece grows near the Swan Pond in the southern part of the Arboretum.

The cover drawing represents the Tea House in the woods near the road west of the Mansion. It was brought from Japan.

The photograph and the drawing were made by Gustave Liebscher.

RODNEY H. TRUE

TREES AS HISTORIANS

THE LONG LIFE SPAN of trees gives them a real interest to us creatures of a mere three score years and ten, for one reason, because of the fact that some of them leave in their bodies a simple record of their conditions of life during the past seasons. Some of them form the so-called annual rings seen in the cut ends of their trunks—wider rings in seasons of prosperity, narrower ones in lean years of drought, or of other kinds of hardship.

This simple record is seen very clearly in kinds of trees in which the growth of the wood is marked by the larger elements of the early spring growth followed by the denser structure of the wood laid down in the latter part of the season. Some trees show annual rings very clearly, mainly because of the large wood vessels laid down in the spring. Among the kinds of wood showing easily-seen rings are the oaks, the ailanthus, ash, elm, hackberry, sassafras, the pines, hemlock, coffee tree, honey locust, and others. Among the sorts in which the rings are less easily distinguished are the maples, poplars, willows, birches, red cedar, apple tree, sour gum, and others. Fortunately, certain of the long-lived trees have well-marked rings that on study may tell tales of the celestial happenings, of drought and of other conditions in their immediate environment, and in any case tell a tale of survival through the centuries. Among these are the "big trees" of California that in their great stumps show a cross-section of hundreds of years of history.

Professor A. E. Douglass, the astronomer of the University of Arizona, discovered that the width of the tree rings of these old trees showed a rhythm of wide rings and narrower rings that coincided with the sun spot periodicity seen by the astronomers. This seems to show that variation in the supply of energy from the sun caused by these spots affects the growth rate of the trees. This gives rise to a recognized succession of ring widths through the lifetime of the trees, that enables the student to date the life period of a piece of timber long since dead and passed into use. From a study of trees of known date of death, it has been possible to extend the pattern of the series of ring widths hundreds of years into the past. By using this scale it has been possible to date old timbers from the prehistoric cliff dwellings with great accuracy. This study of tree rings has developed a technic and a body of information published in a periodical devoted to this combination of Botany and Astronomy, known by the name of "Tree Rings." A file of this periodical may be seen in the Botanical Library at the University.

The tree's rings may point out humble happenings. A certain farmer laid his lack of success in farming to wells drilled for use by a large industrial plant in which much water was used. He laid his failure for the last decade to the underground

drought caused by the pumping out of great volumes of water from wells that he thought were supplied with water from under his farm. Two groups of trees having sharply marked rings were selected for study—a group of oaks near the pumping plant and a group of sassafras trees on the line between the farm and the plant. The rings of the oaks near the plant when measured showed a reduced growth during the decade following the installation of the pumps, and seemed to reinforce the contention of the farmer. The sassafras trees on the farm line toward the pumps, however, showed the highest prosperity during the same decade, arguing against the farmer. The contradiction in the evidence was explained when it was found that a storage tank of crude oil had broken ten years before not far from the oaks. They responded to the damage to their roots caused by the oil. The sassafras trees, remote from this accident, told the true story.

Probably few people remember that almost seventy years ago a railroad went up along the Brandywine through a region now a park in Wilmington, Delaware. In trying to account for the setback shown by a large red oak that fell some years ago in this park, the ring story caused a study of the past to be made. It showed that at the date indicated by the injury shown by the rings, the track passed near this tree, resulting in a severe injury to the root system. This caused the narrow rings, recording unfavorable conditions at that remote date.

Among the early maps of the region now making up the eastern parts of Pennsylvania and of Maryland is one dated 1681, on which a large oak is shown. It still stands as a noble landmark defining a definite spot by which men have oriented their boundaries for generations. Dr. Wildman has told something of its story, as the "Richards Oak," in his little book on "Penn's Trees."

Trees as landmarks is a subject that needs pages for any adequate discussion.

RODNEY H. TRUE



TREES IN TROUBLE

IT WAS THE FORTUNE of the writer to be in New England during the hurricane of Wednesday, September 21st, and succeeding days, and certain general observations on the effect of the conditions on trees seemed worth noting.

To begin with, a rainy week had preceded the day of the wind. The soil was saturated, and water had already been draining away from the forest floors, from the hillsides and the mountain slopes, before the wind came. As a result, the root systems of the trees were in a yielding medium that gave them less-than-normal support. One result of this condition was seen in the landslides that filled the roads in steep places.

On Wednesday, a gusty wind blew at times with a shiftiness that passed into a steadily increasing gale as the afternoon wore on. At about 6 P. M. a hard rain joined the wind. The low clouds drove with great speed inland, and as darkness came on the nature of the situation began to develop. At 6:15 P. M., electric connections failed at Conway, New Hampshire, and candles were hastily brought into use. At North Conway, half an hour later, all was in darkness. A night of wild winds followed, in which chaos seemed to be creeping out of the darkness. Daylight revealed what had been done. The fall of trees in streets, and the destruction of large areas of woodland in the country, closed roads and traffic for long distances. Wires were down in all directions, paralyzing telephone and telegraph service, isolating many communities and leaving them without light and heat. Refrigerators without cold upset the restaurants, where ice cream melted and meats threatened to spoil.

Nevertheless, the clear atmosphere of Thursday brought the mountains wonderfully near, and the brilliance of fall colors was already at hand. Landslides, however, cut off some of the roads in the Notches for the time being. Everywhere was activity in clearing the streets and roads of fallen trees. Men were on roofs of houses trying to protect the places damaged by the fall of great trees. For long stretches there was hardly a yard that had not suffered the loss of one or more of the great white elms that make New England villages so attractive.

By Friday time enough had elapsed for the water to get into the larger channels, and rivers became a source of trouble. In attempting to escape from the chaos of fallen trees, damaged houses, lack of light and tangled telegraph and telephone wires, the driver went where he could in the direction he wanted to go, and drove as far as he could. By Friday, evidence of help from outside was at hand, when perhaps half a dozen repair trucks bearing Pennsylvania licenses were seen working on the broken and tangled wires. At one place the bridge was awash, but it still held; a great manufacturing plant was nearly burned out in the second day of disaster; the streets were full of ruined trees being cleared to make way for cars, and the place was under martial law. Slouching civilians with guns on their hips were helping the veterans, distinguished by their overseas caps. By night, South New Hampshire was reached, but again the city was at the candle-light stage. One street entrance to the main thoroughfare had accumulated tin roofs that had rolled to the ground; a church steeple was still on the church, but hanging at a dizzy angle; the trunks of the great elms that had made the town most attractive were still in the street, and barriers to commerce in the prevailing darkness. An empty gas tank had burst from underground and turned up sidewalk and street. Restaurants lighted by candles served food. The manager of a neighborhood hardware store, under command of an officer in charge, could not close up, though darkness was coming on, because of the constant need of shovels, axes, roofing materials, and other things in his store. He

was ordered to keep his store open until the military control told him to close. Crews of men were brought in trucks to points of special need, and in one place tired prisoners in charge of officers were being marched into their place of confinement.

At last, escape from chaos, being handled competently and bravely, was possible, but the tremendous losses in homes, in trees that made the towns beautiful, and in financial values wiped out in the fall of extensive forest growths, remain.

The trees chiefly concerned in the events noted behaved each in its own fashion. In the saturated soil, shallow-rooted trees were usually tipped over, with root systems bearing a load of soil or stones thrust up into the air. Such trees less often broke to pieces, but many large branches were often split off. The large white elms, poplars and pines were usually tipped over. The more deeply-rooted sorts were less often overthrown, but rather broke off or broke up, with a part of the trunk still upright. The rock maples and oaks often behaved in this way.

The trees fallen in groups in the forests form hopeless tangles, from which the logs will be hard to retrieve. Moreover, these twisted and wrenched logs will not be very acceptable for lumber. For firewood the cost can hardly be met by the low value of the product that is now available in such large quantities.

Among the different kinds of harm wrought by the storm, the great financial losses are strikingly exhibited, but how is the loss of the great trees from the homes, of which these sturdy citizens have been a part of the everyday life of people for generations, to be assessed?

It is a matter of deep regret to all botanists and lovers of beauty to learn that the Arnold Arboretum near Boston suffered severe losses from the hurricane. Unfortunately, not only was the loss in numbers of trees very great, over 1500 trees, but many old and many rare trees were blown down.



THE ANNUAL BUS TRIP

THE FIFTH ANNUAL BOTANIZING TRIP of the Morris Arboretum and the Department of Botany took place during the week of June 6, 1938. As in the past, the expedition was organized by Dr. Rodney H. True, the party was made up of members of the staff and graduate students of the Department of Botany. The purpose of the trip was to make an intensive study of the flora of a section of Pennsylvania, not previously explored by botanists from the University.

Since preceding bus trips have covered that portion of the state lying to the east of the Susquehanna River, the present itinerary was drawn up with a view to

visiting the area slightly to the west and the north—an area lying chiefly in Bradford, Sullivan, Columbia, Luzerne and Lycoming Counties. In each of these counties numerous stops were made and large numbers of specimens collected.

Leaving Philadelphia early on Monday, June 6, the party proceeded northward by way of Reading and Pottsville to Centralia in Columbia County, where the first stop was made for the purpose of collecting. The habitat was that of a dry acid hilltop capped by scrubby oak growth and supporting the predominant ericaceous flora characteristic of such a site. The most noteworthy feature of the vegetation was the prevalence of a dwarf species of Juneberry (*Amelanchier stolonifera*).

The bus then continued northward to Willow Springs, along the East Branch of the Susquehanna River, west of Berwick, which marked the end of the day's run. Here considerable collecting was done along the north shore of the river. The rich alluvial thickets were full of interesting plants, among them the Sandbar Willow (*Salix longifolia*) and the Water Willow (*Dianthera americana*).

On the following day, June 7, the party began working westward and northward. In an endeavor to see still another type of habitat within the same county, a rich wooded slope a mile and a half north-northeast of Iola was selected as the first stop. By deploying fanwise up this hillside, the members of the party were able to attack it over a front of half a mile. When they reassembled at the bus an hour later to compare observations and specimens, it was found that many worthwhile species had been collected. The flora was decidedly boreal in character, as attested by the occurrence of such plants as Mountain Maple (*Acer spicatum*) and Fire Cherry (*Prunus pennsylvanica*).

Abandoning Columbia County for the time being, the bus moved on into Sullivan County where, during a brief stop for lunch at Muncy Valley, some very intensive collecting was accomplished. Many of the same species which had been collected in Columbia County were now taken again, in order to have them represented in the herbarium from a new county. In addition, numerous plants which had not been found before were now brought to light, such as Painted Trillium (*Trillium undulatum*), Clintonia (*Clintonia borealis*) and Bunchberry (*Cornus canadensis*).

Turning westward now, the bus ran before a heavy wind and rainstorm to Montoursville, in Lycoming County, which had been selected as the destination for the night. Here, along the West Branch of the Susquehanna River, the closing hours of the day were devoted to an exhaustive scrutiny of the alluvial beaches and thickets at the water's edge. Here, again, were Sandbar Willow and Water Willow and many of the same species seen along the East Branch of the river the preceding afternoon. Perhaps the most interesting novelty was the Leatherwood (*Dirca palustris*), a few scattered plants of which were detected by Miss Mildred Travis.

Wednesday morning, June 8, found the party exploring the wooded hills along the Loyalsock Creek, north of Loyalsock, a region noted for its wild and rugged beauty. The slopes were covered with a thick growth of hemlock and rhododendron, among which were scattered many boreal or Canadian species, such as *Lycopodium annotinum* and *Coptis groenlandica*. Resisting the temptation to spend the entire day on these fascinating slopes, the party re-entered Sullivan County and, proceeding eastward to Forksville, climbed up to the wild plateau country lying to the north of Eaglesmere. Here the party was split into groups or teams to facilitate the exploration of all the available habitats. A cranberry bog along Double Run yielded *Cassandra* (*Chamaedaphne calyculata*), Mountain Holly (*Nemopanthes mucronata*) and a rare northern species of Cotton-grass (*Eriophorum spissum*). Deep wooded hillslopes harbored colonies of *Hepatica acutiloba* and *Oxalis montana*, good northern species. One team brought in the first Mountain Ash (*Sorbus americana*) of the trip, another had discovered the trailing dwarf raspberry (*Dalibarda repens*), and so on, each team presenting its own finds for the rest of the party to admire or disparage, depending upon whether or not they themselves had found them.

A brief stop was made at the picturesque Lincoln Falls, along Elk Creek, to visit one of the few localities within the state for the very rare Slender Cliff Brake (*Cryptogramma Stelleri*). This attractive little fern grows on the bare ledges of the rocky gorge just below the Falls.

Leaving Sullivan County, the bus now headed northeastward into Bradford County, landing the party late in the afternoon at Wyalusing Rocks along the East Branch of the Susquehanna. By postponing dinner until dark the party was able to take advantage of the splendid botanizing here offered by the steep cliffs, the river shore and a deep wooded ravine, the last-named all-too-hastily scanned in the failing light.

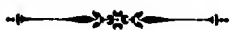
On Thursday, June 9, the expedition returned to Sullivan County, stopping first at a mine site, east of Mildred. Here a large collection on fossil plants was made first at a mine site, east of Mildred. Here a large collection of fossil plants was made on the slate piles and the first Hairy Blueberry (*Vaccinium canadense*) of the trip was collected. The greater part of the day was employed in working the area around Lopez. Here again the practice of dividing the party into groups of two or three each was adopted with gratifying results. Probably the outstanding discovery of the day was a fine colony of the rare *Polemonium Van-Bruntiae*, found by Mr. Paul Wagner along Cold Run, southeast of Lopez. Among the worthwhile finds brought in by the various parties were *Abies balsamea*, *Calla palustris*, *Arisaema Stewardsonii* and *Habenaria orbiculata*.

That evening saw the party back at Willow Springs, where the first night had been spent. This time a small delegation was dispatched to the far or south side of the river and came back with a whole new lot of species including the very uncommon *Rumex altissimus*.

On Friday, June 10, the bus headed for home. Only one important stop was made, that in Luzerne County along the Big Nescopeck Creek, north of Conyngham. No unusual species were found, but an intensive scouring of the woods and stream banks yielded a large and varied collection, which will go far toward filling in our knowledge of distribution within this county.

That the 1938 trip was eminently successful may be gathered from the fact that the combined collections of the party totaled over 1300 numbers. These have now been mounted and inserted in the University Herbarium, as a result of which five counties, about which comparatively little had been known, are now substantially represented by specimens, and our steadily growing body of knowledge of the flora of the state has been materially increased.

JOHN M. FOGG, JR.



BOTANICAL ACTIVITIES OF THE ARBORETUM STAFF

EDGAR T. WHERRY

Dr. Wherry spent the summer studying the habits of native ferns from Connecticut to South Carolina, traveling over 10,000 miles and collecting about 500 specimens. The most notable find was a colony of Slender Rock-brake, *Cryptogramma stelleri*, in West Virginia, 200 miles south of its previously known limit in northern Pennsylvania.

H. H. YORK

As Special Investigator and Consulting Forest Pathologist for the New York State Conservation Department, Dr. York devoted the past summer to continuing his investigations on diseases of coniferous trees in forest plantings. The greater portion of his time was spent in the municipal forest plantings of the City of Rochester, New York, which are located on the watersheds of Hemlock and Canadice Lakes. These watersheds comprise approximately 3000 acres and constitute the second largest municipal forest plantings in the country, those of New York City being the largest.

Dr. York also made a number of trips to the Morris Arboretum, where he directed a pathological survey carried on by Messrs. Spencer Davis and John Harry, graduate students in Forest Pathology at the University of Pennsylvania.

JOHN M. FOGG, JR.

Dr. Fogg spent the month of July at the Mountain Lake Biological Station at Mountain Lake, Virginia, where he again taught in the summer session of the University of Virginia. He also assembled a large collection of plants from this interesting region for the University Herbarium.

During August, Dr. Fogg made two field trips, one to the foothills of the Adirondacks and another into central and western Pennsylvania, where extensive collections were made in counties in which little or no botanical work has been done.

JAMES LAMBERT

Mr. Lambert, superintendent of the Arboretum, drove westward to San Francisco, where he got a collection of specimens of rare plants from the Golden Gate Park. He drove south and collected plants in the Sierra Mountains arriving in San Diego, thence east across Arizona, New Mexico, and finally to Florida. Special attention was given to the *Dionaea* and *Sarracenia* forms in the Southern States. Over 100 living plants were brought to the greenhouses at the Arboretum for cultivation.

J. W. ADAMS

Mr. Adams, Assistant in the Herbarium, in company with Dr. E. T. Wherry, visited the Stewartstown area, York County, Pennsylvania, in the spring, to study Harford County, Maryland, and in Fulton, Bedford and Somerset Counties, Pennsylvania. Perry County, also, was visited in the summer.

F. RAYMOND FOSBERG

Mr. F. Raymond Fosberg, Morris Arboretum Fellow, spent most of the summer working in the Herbarium at the University of Pennsylvania on taxonomic studies of Hawaiian plants. He made three visits to other herbaria—one to Washington, one to the Gray Herbarium at Cambridge, Massachusetts, and one to the New York Botanic Garden.

In addition, Mr. Fosberg collected plants in Southern Virginia, Northern Pennsylvania, the Adirondack Mountains, and in New Jersey. Altogether, approximately 2000 specimens were collected by him.

ERNEST LUDWIG

Mr. Ernest Ludwig, a graduate student in Botany at the University, was appointed to a fellowship, granted by the "Friends of the Wissahickon," to make a thorough study of the present flora of the Wissahickon Valley. This was begun during the summer under the supervision of Assistant Professor John M. Fogg, Jr.

RODNEY H. TRUE

In the early part of August trips were made in quest of plants found in the calcareous northern part of Warren County, New Jersey.

The latter half of the month and the early part of September were spent in company with Oliver M. Neal, Jr., of the University of Maine, in collecting in Northern Maine. Collections were made from Mattawamkeag to the St. John River in Penobscot, Aroostook and Washington counties. The northern limits of the more southern flora, and the southern appearance of plants from a more northern range, were in evidence. About 1200 specimens were collected for the Herbarium during the summer.

ORGANIZATIONS VISITING THE ARBORETUM IN 1938

THE CLASSES from the Department of Botany of the University of Pennsylvania have made frequent visits to the Arboretum. Various other scientific and educational institutions have been represented by groups varying in number from a dozen to fifty. Among them the following may be mentioned: National Association of Gardeners, Philadelphia branch, Mt. St. Joseph group, Oak Lane Country Day School, Garden Club of America, Methodist Deaconess Home, the Lawrenceville School, the choir of St. Thomas' Church, Temple University group, Springside Junior School, Academy of Natural Sciences group, New Century Club, Botanical Society of Pennsylvania, Education Alumni Association of the University of Pennsylvania, Ambler School of Horticulture, Business and Professional Women's Club, Matinee Music Club, and Pi Lambda Theta party.

Perhaps the greatest number of organizations visiting the Arboretum belonged to the Garden Clubs. The following clubs were officially represented by groups: Garden Club of Wallingford, Somerton Woman's Club, Bywood Woman's Club, Twin Valleys Garden Club, Norristown Garden Club, Countryside Garden Club, Moorestown Garden Club, Four Counties Garden Club, the Planters Club of West Chester, Woman's Club of Woodstown, New Jersey, and the Penn Valley Garden Club.

The outing groups came as organizations. Among them were the Back to Nature Hiking Club, a group of boys from Dr. Krasnoff's camp, and the Field Club of the University of Pennsylvania.



VISITORS FROM GERMANY

AMONG our many visitors at the Arboretum was a group of members of the German Dendrological Society sent to America to study American arboreta. Plans for the planting of three extensive arboreta in Germany are now being made, and a committee of experts is studying American institutions of this type. The Committee, consisted of the following members: President, Herr von Schroeter, the two Counts Henckel von Donnersmark and Herr von Madgeburg, accompanied by Mr. H. F. Riebe, of the Henkel & McCoy Company.

The itinerary of this Committee followed the recommendations of Dr. Hellmut L. Spaeth, of the long-established firm of Spaeth, Berlin, who paid the Arboretum a previous visit on March 23rd. It was understood that the inspection of the Morris Arboretum was the first of a series of such inspections, which would include the Arnold Arboretum, of Boston, and the Morton Arboretum, of Lisle, Illinois.

THE WINTER LECTURE COURSE

DURING the coming winter a course of five lectures, on topics of interest to persons caring for plants, will be given in the Mansion at the Arboretum. The speakers will be authorities on the subjects, and illustrations will add interest to the lectures. Lawns and hedges will be the prominent subjects of discussion, and the course will be closed by the consideration of a novel subject. The program follows:

December 10, 1938

DR. E. M. GRESS

Grasses—I.

Dr. Gress, Botanist, State Department of Agriculture, will discuss the general subject of grasses. He studied at Bucknell College, and took his advanced degree at the University of Pittsburgh. He has been a teacher. He has published papers on various botanical subjects, his excellent bulletin on the "Grasses of Pennsylvania" being his latest major work.

January 14, 1939

DR. JOHN MONTEITH, JR.

Grasses—II.

Dr. Monteith, who is a Pathologist in the U. S. Department of Agriculture, will discuss phases of the grass problem seen in lawns and golf courses. He received his early training at Rutgers University, taking his higher degrees at the University of Wisconsin. He has been with the Department at Washington since 1923.

February 11, 1939

MR. HARRY WOOD

Hedges—I.

Mr. Wood is connected with the Arthur Hoyt Scott Foundation of Swarthmore, Pennsylvania, and has had wide experience in America and in England in practical horticulture. He will discuss the general subject of hedges, materials used, purposes sought, and treatment given to hedges.

March 11, 1939

MR. R. W. OLIVER

Hedges—II.

Mr. Oliver, of the Central Experimental Farm at Ottawa, will discuss hedge problems and materials, presenting the results of novel work on hedges being done at Ottawa. Visitors seeing this work speak highly of the results.

April 15, 1939

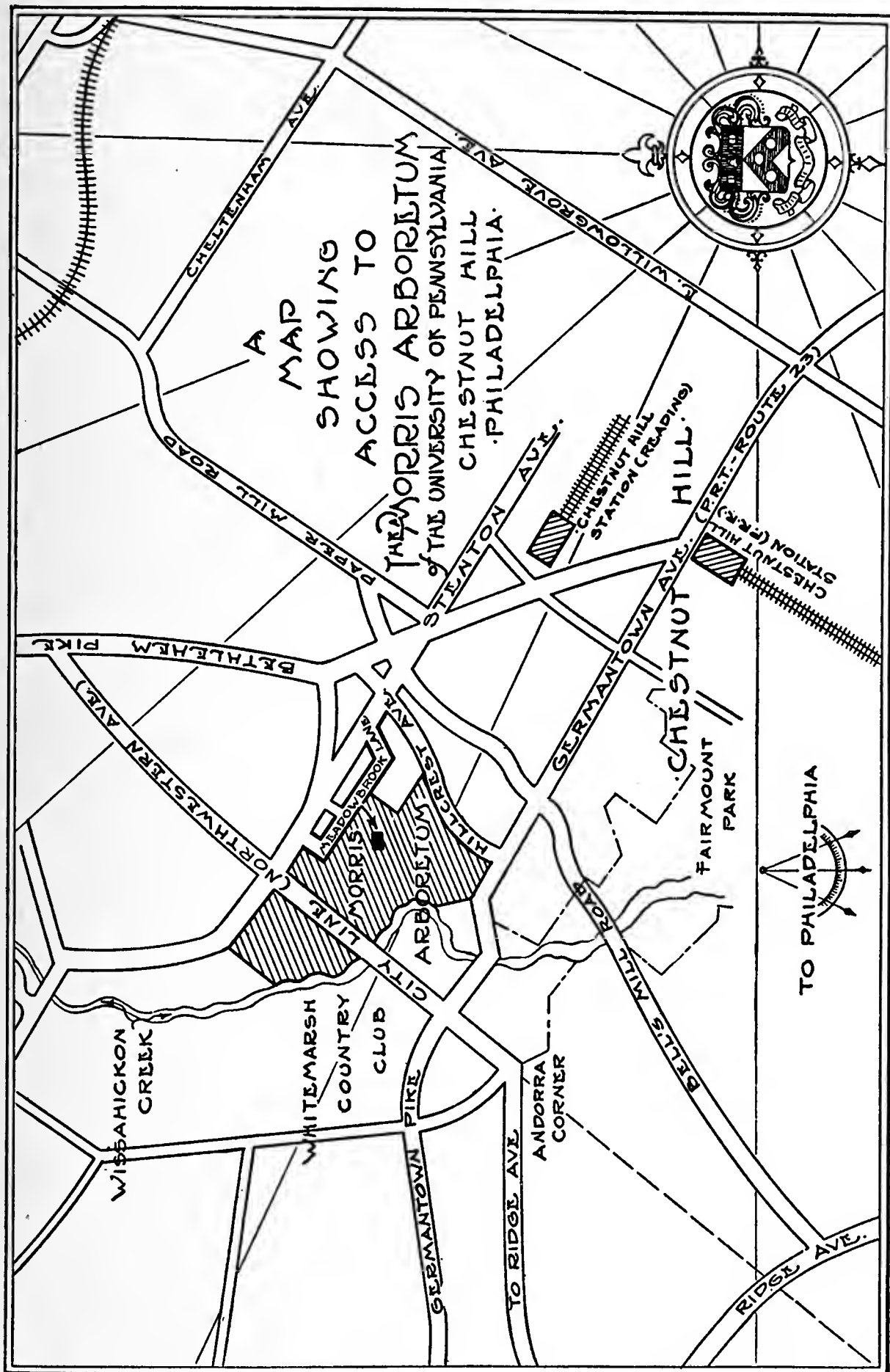
MRS. A. C. BARNES

Cultivation of Hardy Ferns

Mrs. Barnes is Director of the Arboretum of the Barnes Foundation at Merion, Pennsylvania, and has given special attention at the Barnes Arboretum to the cultivation of a very large number of hardy ferns, one of the attractive and novel features of this very beautiful and interesting institution.

The Arboretum of the Barnes Foundation was started in 1922, when the property was acquired from the late Captain Joseph Lapsley Wilson, who made it a condition of the sale contract that the plantings of trees begun by him in 1887 should be preserved. At present, the Arboretum contains about 1,250 species and varieties of woody plants, including some rare and unusual trees, 250 Lilacs, 245 Roses, Cotoneasters, Barberries, broad-leaved evergreens, etc., which, together with the 88 species and varieties of hardy ferns in the woods, form a collection containing well-developed specimens of decorative as well as horticultural interest.

Lectures will begin at 2:30 P. M. Guests coming in cars will find convenient parking space near the entrance on Meadowbrook Lane.



ARBORETUM BULLETIN
OF THE
ASSOCIATES

JANUARY, 1939



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Atlas Cedar
Cedrus atlantica Manetti

ARBORETUM BULLETIN, JANUARY, 1939

The frontispiece of this number is from a photograph of one of the Atlas Cedars, *Cedrus atlantica* Manetti, growing at the Morris Arboretum. This tree is native in the Atlas Mountains in northwestern Africa, where it becomes a large pyramidal tree reaching a height of 120 feet (Bailey), with upright leading branches. The clustered leaves are mostly less than an inch long, and have a bluish-green color. The cones are light brown, 2 to 3 inches long, and about 1½ inches broad. It was introduced to this country before 1840.

The cover illustration represents the marble fountain seen in the Rose Garden.

The photograph and drawing were made by Gustave Liebscher.

FAMOUS TREES

IT IS INTERESTING to note that the Department of Agriculture in Washington is taking cognizance of the popular interest in trees. An illustrated pamphlet of 165 pages, with 50 half-tone pictures, known as "Miscellaneous Publication No. 295," has been put out at the moderate cost of 15 cents. It is entitled "*Famous Trees*," and deals with such from all states in the Union. Charles E. Randall and D. Priscilla Edgerton are the authors.

It is also interesting to see in what ways trees have become famous. In this booklet, one large group are famous because of their association with notable persons, events and places. Their fame comes from these associations, rather than from any property or properties of their own.

In this group is the Clara Barton Centennial Oak, at Glen Echo, near Washington, planted by the American Forestry Association in 1922, in front of the house in which the founder of the Red Cross died in 1912. The "Washington Elm" is opposite the east entrance to the Senate wing of the Capitol at Washington. An even more famous elm, associated with the Father of his Country, was the "Washington Elm" (now gone), at Cambridge, Massachusetts, under which he took command of the Revolutionary forces in 1775. A host of its descendants and other "Washington" trees illustrate this type of transferred fame.

Trees associated with presidents, battles, treaty signings, and meetings of various kinds, are numerous. Some deal with religious occasions, as the "Catholic Oak" at Lonsdale, Rhode Island; the "Huguenot Oak" in Oley Valley, Berks County, Pennsylvania; the "Wesley Live Oak" on St. Simon Island, off the Georgia coast. The "Michaux Grove" of oaks in Fairmount Park, Philadelphia, celebrates a famous French botanist.

Another group of famous trees are notable for the properties of the trees themselves. The most conspicuous sources of fame of trees in this class are their age and great size. Great size is an obvious quality; that of age is less safely asserted. The number of rings gives authentic information, but the number and width of rings is not to be ascertained in many still living large trees. However, Professor A. E. Douglas, astronomer of the University of Arizona, has developed a technique by means of which timbers, as well as whole trunks, may be dated. His chronology now carries definite dates among the great trees of the west back to 1305 B. C. for the sequoias, covering 3,243 years to present date.

For size, the trees of the west seem to hold the palm for the United States. Among the big sequoias, known to many, is the "General Sherman" (*Sequoia*

washingtoniana), more commonly, *S. gigantea*, which seems to be the largest tree in the country. It has a diameter of $36\frac{1}{2}$ feet, with a circumference of nearly 115 feet, a height of 272.4 feet, a volume of 600,120 board feet, and an age of between 3,000 and 4,000 years.

Other giants are to be found among the redwoods, sugar pines, eucalyptus and oaks of the far west. One of the largest oaks in a Canyon live oak, near Tuolumne, not far from Yosemite National Park, California, with a circumference of $31\frac{1}{2}$ feet, a height of 60 feet, and a spread of 131 feet. Other oaks with a circumference of more than 25 to 30 feet are noted. The tallest trees seem to be redwoods, reaching a height of 364 feet near Dyerville, Humboldt County, California.

Great trees are reported from many parts of the country. In the east, the white elm is noted for its size. The "Great Elm" of Weathersfield, Connecticut, is here regarded as being in all probability the largest living elm. This elm bears a sign stating that "The Great Elm is nine feet, six inches in diameter, 29 feet, six inches in circumference. Age 172 years, 1930. The height is 130 feet, with a branch spread of about 150 feet."

Two giant elms are reported from New York. The "Gowanda Elm" of Gowanda, Cattaraugus County, New York, has a circumference of 39 feet near the ground, of 20 feet at a distance of 50 feet from the ground. Bigger yet is the "Markham Elm," two miles north of Avon, Livingston County, New York, having a circumference of 40 feet, with 600 annual rings. The "Rathbone Elm" of Marietta, Ohio, has a girth of 27 feet at a distance of $3\frac{1}{2}$ feet from the ground.

Prominent among the long-lived kinds that reach great sizes are the oaks, particularly the *white oak* of the northern states. Among the records of such trees occur several in the Middle Atlantic States. In Maryland, the "Wye Mills" tree, nine miles from Easton, Talbot County, is well known to many tree lovers of this region. In 1930, it had a circumference of 20 feet, with a spread of 140 feet, and an estimated age of 391 years. Near Landover, Prince George's County, is a white oak, having in 1928 a circumference of 25 feet, one inch, at breast height (four feet, six inches), a spread of 96 feet, and a height of 96 feet.

Known to fewer Philadelphians, perhaps, is a great white oak growing at Kutztown, Pennsylvania, having a girth of 31 feet at the ground. This is thought to be the largest white oak in Pennsylvania.

The "Johnson Oak" at Northford, Connecticut (kind not noted) had a girth of 30 feet in 1800, with a spread of 111 feet. This is equalled by the "Revolutionary Elm" of Reading, Connecticut, with a circumference of 30 feet, six inches, and a spread of 112 feet. The kind is again not noted.

Among the oaks, the white oak seems to reach a greater size than other kinds. However, large red oaks are known over a wide area. One at Lloyd's Neck, Long Island, has a circumference of 16 feet, eight inches at three feet. Several large red oaks are reported from the south. A red oak from Lancaster, Massachusetts, has a girth of 20 feet, a height of 75 feet, and a spread of 90 feet. The "Confederate Tree" from Oxford, Mississippi, has a girth of 15 feet. A tree from Chipley, Florida, is the largest reported plant of this species, having a girth of 25 feet.

Other oaks of large size are reported. The largest burr oak seems to be at Huntington, Pennsylvania, with a girth of 29 feet one foot from the ground. A swamp white oak near Bedford, Bedford County, Pennsylvania, is 27.5 feet around. A chestnut oak, the "Sacred Oak" of the Delaware Indians, growing northeast of Reading, is 22 feet around, with a spread of 116 feet. In Mississippi County, Missouri, a tree of *Quercus macrocarpa* reached a circumference of 20 feet in 1932.

The largest species of the south is the spreading live oak. A notable specimen is found near Daytona, Florida, with a circumference of 35 feet, and another known as the "Locke Brean" tree in St. Charles' Parish, Louisiana, has a girth of 35 feet, a height of 75 feet, and a spread of 166 feet.

Nearly related to the live oak is the southern water oak, likewise a large tree. One at Toddsburg, Gloucester County, Virginia, reaches a girth of 26 feet, with a branch spread of 120 feet.

The sycamore, or buttonwood, is a rapid-growing species that reaches a great size. Near Worthington, 70 miles southwest of Indianapolis, Indiana, is a specimen having a circumference of 42 feet, three inches, at five feet above the ground, a height of 150 feet, with a spread of 100 feet. Near Neshaminy Creek, 15 miles from Philadelphia, is a sycamore 34 feet in girth.

The sassafras, not usually a large or long-lived species, may reach an old age and large size. Virginia boasts a sassafras near Keswick with a circumference of 18 feet, six inches, at five feet from the ground, and at Casey, Laclede County, Missouri, is a specimen having a girth in 1931 of 15 feet, six inches, at a distance of six feet from the ground.

The chestnut has left some records that add to our regret at the loss of this magnificent species. A tree near Spinnerstown, Bucks County, Pennsylvania, has a circumference of 33 feet two feet from the ground, and a height of 90 feet. The estimated age was 220 years. It was supposed to be the largest chestnut in Pennsylvania. Another giant specimen, having a girth of 33 feet, four inches, seven feet from the ground, was found three miles from Crestmont, North Carolina.

The cucumber tree, *Magnolia acuminata*, attained a circumference in Gales Woods, Morrow County, Ohio, of nine feet.

The tulip poplar is one of our loftiest trees, though not equally noted for its circumference. A specimen 15 miles from Asheville, North Carolina, is one of the largest specimens reported, with a height of 198 feet and a circumference of 28.7 feet at breast height.

The bald cypress reaches a circumference of nearly 50 feet $1\frac{1}{2}$ miles west of Eagletown, Oklahoma, with a height of about 100 feet.

The arbor vitae tree at the Natural Bridge, Virginia, has been noted since the days of Thomas Jefferson, on one of whose places it was situated. The size of this tree is remarkable, having a girth of 15 feet and a height of 90 feet.

The Plains States are not lacking in large trees. The cottonwood is the most outstanding tree of this general region, and seems to be well represented at Milford, Nebraska, by a specimen having a circumference of 36 feet at a height of five feet from the ground, a height of 128 feet, and a spread of 78 feet.

The white pine, once the dominant tree over a vast area of the north, is not one of the largest trees. A white pine, cut at Cedar Run, Lycoming County, Pennsylvania, had a circumference of 37 feet, and was about 200 feet high. A white pine, thought to be the largest specimen in the nine states of the north central west, was found at Pike Bay, west of Cass Lake, Cass County, Minnesota. It has a circumference of 14 feet, a height of 130 feet, and a content of 5,960 board feet. It is supposed to be over 400 years old.

Dr. Edward Wildman's "Penn's Woods" should have a keen interest to lovers of trees in this region. It is a little book of 192 pages and many illustrations, with reproductions of early maps, listing and briefly describing the trees of this general region in the states of Pennsylvania, New Jersey, Delaware and Maryland, supposed to have been living when William Penn came to "his woods." From this book we learn that this region is unusually rich in old trees, even though the record for the nation may not be made here.

To visitors at the Morris Arboretum, it may be of interest to know that among the trees on the Arboretum grounds are several worthy of notice. Among them are the following:

No. 1280. White ash (*Fraxinus americana*) 15 feet in circumference at breast height, $4\frac{1}{2}$ feet from the ground, with a height of between 100 and 110 feet. It is below the greenhouses.

No. 1641. Box elder (*Acer negundo*) 13 feet in girth and 70 to 80 feet high, near the East Brook, not far from the Wissahickon.

No. 2227. Weeping willow (*Salix babylonica*) 14 feet, 10 inches in girth, 80 to 90 feet tall, near the stone bridge at the Swan Pond.

No. 627. Chestnut Oak (*Quercus montana*) nine feet, 10 inches in circumference, height 100 feet, in the woods near the Japanese Tea House.

No. 1074. White oak (*Quercus alba*) 11 feet, six inches, in girth at breast height, 80 to 90 feet tall, near the Garage.

Tulip poplar (*Liriodendron tulipifera*) 12 feet, eight inches in circumference, with a height of over 100 feet, in the woods near the Wissahickon, below the greenhouses.

In closing, it may be good for us to know that in the realm either of large trees or of old trees, other lands lead.

Probably the tallest tree still standing is an old Eucalyptus tree in Victoria, Australia, with a height of 325 feet. The tree of greatest circumference is the famous Cypress of Tule, (*Taxodium mucronatum*), a few miles east of the city of Oaxaca, Mexico. Different measurements vary somewhat. Shamel, of the U. S. Department of Agriculture, found the circumference on October 4, 1936, to be 113 feet, four inches, the diameter 36 feet, one inch, and the height 118 feet, seven inches. Von Schrenk, consulting engineer of St. Louis, Missouri, in 1933 found it to be 140 feet high, with a circumference of 117 feet at 40 inches from the ground. The estimates of its age vary from 4,000 to 10,000 years.

RODNEY H. TRUE



CONFERENCE ON THE PLANE TREE DISEASE

IN HIS LECTURE on the "*Diseases of the Plane Tree*," delivered at the Morris Arboretum on January 11, 1936, Dr. Lyle W. R. Jackson, of the Allegheny Forest Experiment Station, gave first public announcement of the results of his work on a new and very destructive disease ravaging the street trees of Lower Merion, and other places on the Main Line near Philadelphia. A summary of his lecture, printed in the January, 1936, number of the ARBORETUM BULLETIN (Volume I, No. 2, pages 22 and 23) was the first publication dealing with this new threat to our trees.

The disease has continued to operate in the city, and now appears in Baltimore, and perhaps elsewhere. It has every characteristic of being a serious menace to the plane tree, now so much used in city plantings in the East.

The serious nature of this menace is being more adequately realized, with the result that a conference of interested persons and agencies was called by Mr. R. D. Forbes, Director of the Allegheny Forest Experiment Station, to meet on November 10th, at the Macfarlane Hall of Botany, to consider the situation and to see what could be done about it.

A wide variety of interests was represented in the conference. Dr. R. Kent Beattie, of the Office of Forest Tree Diseases, came from the U. S. Department of Agriculture. George Wirt, of the Department of Forests and Waters, R. H. Bell and K. W. Lauer, of the Bureau of Plant Industry, represented the State organizations. H. J. Howe, City Forester of Baltimore, John C. Wister, Secretary of the Pennsylvania Horticultural Society, H. Gleason Mattoon, President of the Pennsylvania Forestry Association, representatives from the Botany Department of the University of Pennsylvania and the Morris Arboretum, also from several nurseries, and Mr. S. N. Baxter, Arboriculturist of Fairmount Park, were among the number present.

A party under the guidance of Mr. J. G. Kenealy, Forester for the Tree Board of Lower Merion Township, in the forenoon visited regions in which the ravages of the disease could be seen in several stages.

In the afternoon, the conference re-convened in Macfarlane Hall of Botany at the University. The serious character of the disease was a matter of general agreement, and the future development of the situation was considered. Ways and means for dealing with the problems were then discussed. Dr. Beattie, from Washington, clearly and fully explained the ways of securing Federal aid, and made it clear that such was not likely to be available in the near future.

Mr. Bell also indicated that the State agencies of Pennsylvania were not in a position to aid. It was then proposed that private support should be sought among people most likely to be interested, in the hope of making a beginning to cope with the situation. Mr. Forbes, as chairman of the conference, was instructed to appoint a committee to take the lead in future work.

The committee is to have wide powers, with two main objectives: the first to be to raise funds to enable the University of Pennsylvania to carry on research on the Plane Tree Disease, and secondly, to develop other ways and means of furthering this and other investigations of ornamental and other trees.

The Committee appointed by Director Forbes consists of the following members:

H. GLEASON MATTOON, <i>Chairman</i>	
PHILIP E. ALDEN	H. J. HOWE
R. H. BELL	J. H. HUMPHREYS

NEW PLANTINGS AT THE ARBORETUM

THE PLANS FOR PLANTING at the Arboretum are based on the system of roads and paths shown in the general plan prepared by Olmsted Brothers some years ago, and adopted as a general guide to further developments.

In this plan a main axis road, 20 feet wide, takes a curved course down the slope from the present garage to the wide hillside that slopes toward Northwestern Avenue, where it straightens out and follows a direct line aimed at the proposed site for a group of future buildings, to be built on the hilltop of the Farm in Montgomery County. This road has been surveyed and staked out to the point where it reaches the iron fence bounding "Compton" on Northwestern Avenue. Since the planting of the hillside and meadow does not involve marked changes of contour, the plantings have been made on both sides of this axis with plants from the nurseries on the place. In these, the plants now growing in the original places on Compton have been renewed mostly by cuttings, and thus shrubs from the old plantings are now used in the new groupings. Hence, changes in the old plantings can be made without loss of the types.

The plants appearing on the hillside and meadow toward Northwestern Avenue include several groups. The *Magnolia* group is taking its place below the present service road leading into Meadowbrook Lane on the side toward the lane. Below this group, between the eastern side of the axis road and Meadowbrook Lane, is the large group of Mock oranges, *Philadelphus*. At the north end of Meadowbrook Lane this group continues around the corner almost to Stenton Avenue. Opposite this group, on the west side of the axis road, are the *Deutzias*, *Hydrangeas*, and other members of the Saxifrage family. On the western side of the hillslope is the large group of deciduous *Barberries*, and a part of the *Poplars* extending to the moist level ground of the meadow.

The axis road will cross the brook, which comes from the direction of Flourtown, by a wooden service bridge now being made.

On both sides of the road, in the moist meadow, is the large group of *Spiraeas* that approaches Northwestern Avenue.

Other plantings on a smaller scale have been made in other parts of the Arboretum. The walk among the Japanese Cherries, a beautiful feature along the side of the brook from Chestnut Hill before the severe winters of 1936 and 1937, will soon become a Lilac Walk, in which species and many of the choicest hybrids will make

a feature of unusual interest. The *Forsythia* group nearby is being increased by new types.

Young shrubbery is of course for a time mainly a promise, but as the plants become established and develop their characteristic forms, sizes and colors, these new plantings will become notable additions to the Arboretum.

It is hoped that old friends of the place may be able and interested to trace the features described above.

RODNEY H. TRUE



RECENT AQUISITIONS

SEEDS FROM EDINBURGH

Among the recent acquisitions to the Arboretum is a seed collection presented by Mrs. J. Norman Henry, Gladwyne, Pa., through Dr. Edgar T. Wherry. This material came to her from the Royal Botanic Garden of Edinburgh, Scotland. Among the items, apparently collected by a Chinese collector, Yü, are 15 numbers of *Clematis* seeds, 7 numbers of *Lonicera*, 3 numbers of *Philadelphus*, 2 of *Potentilla*, 3 of *Saxifraga*, and 2 of other members of the *Saxifragaceae*.

GIFT OF ORCHIDS

Through the generosity of a friend of the Arboretum who wishes to have his name withheld, a donation of orchids has recently been added to the Arboretum collection for exhibition and scientific purposes. This collection consists of 108 specimen plants, representing 61 species and varieties, belonging to 17 genera. This valuable contribution has increased the number of orchids at the Arboretum to 157 species and varieties.

While the greater part of this donation represents the showy type of orchid, there are many representative types that have a higher scientific value, but are less showy. Among other scientific types are hybrids of two species belonging to the same genus, or two types belonging to two genera, while three genera are represented in one hybrid. Included in this collection, also, are hybrids developed from the hybridization of other hybrids. These are exhibited in the genus *Miltonia*, a showy type of orchid from Brazil and Colombia, and which are two hybrids between two

species, and nine hybrids which are crosses between hybrids. Another plant, representing the genus *Wilsonara*, is a cross between the three genera—*Cochlioda*, *Oncidium* and *Odontoglossum*. *Odontonia* is another type of bigeneric cross between the genera *Odontoglossum* and *Miltonia*. Other bigeneric hybrids included in the group are *Laelia-Cattleya* and *Brassavola-Cattleya*.

It may be interesting to record the geographical distribution of the plants in this collection. Guatemala is represented by the genera *Oncidium*, *Odontoglossum*, *Brassia* and *Lycaste*. From Mexico we have *Oncidium incurvum* and *Lycaste aromatica*, which are native to that country. Honduras is represented by *Oncidium sphacelatum*. *Bifrenaria Harrisoniae* and *Miltonia flavescens* are indigenous to Brazil, while the West Indies, Peru, Colombia and Costa Rica are represented by the genera *Oncidium*, *Phragmopedilum*, *Miltonia* and *Odontoglossum*, respectively. Africa is represented by the genus *Angraecum*; India, Burma, Cochin China, by *Coelogyne*, *Aerides* and *Vanda*. From the Philippines and Malay Archipelago comes one of the showiest types of them all—*Phalaenopsis*—having large sprays of flowers of good size, and ranging in color from pure white to a rich rose-lilac. The *Miltonia* hybrids are exceptionally valuable, both from the standpoint of beauty and that of scientific value. The outstanding plant for floral structure is the *Oncidium papilio*—the Butterfly Orchid—from the West Indies. The structure of the flower resembles a butterfly's wings, body and head, but has three instead of two antenna-like parts.

JAMES LAMBERT



EXHIBIT OF ORNAMENTAL FRUITS

THE MORRIS ARBORETUM was invited to contribute to the Flower Show of the Pennsylvania Horticultural Society, held in co-operation with the Arthur Hoyt Scott Foundation at Swarthmore, at which chrysanthemums were featured.

Mr. John Tonkin, head gardener of the Arboretum, made and arranged a collection of berries and other ornamental fruits, mainly from the Arboretum and from the plantings of the Arthur Hoyt Scott Foundation at Swarthmore, supplemented by additions from other sources. This collection was a striking feature when seen among a wealth of chrysanthemums and other exhibits of orchard and garden.

A certificate of Merit was awarded to the Arboretum and to the Foundation.

THE WINTER LECTURE COURSE

January 14, 1939

DR. JOHN MONTEITH, JR.

Grasses—II.

Dr. Monteith, who is a Pathologist in the U. S. Department of Agriculture, will discuss phases of the grass problem seen in lawns and golf courses. He received his early training at Rutgers University, taking his higher degrees at the University of Wisconsin. He has been with the Department at Washington since 1923.

February 11, 1939

MR. HARRY WOOD

Hedges—I.

Mr. Wood is connected with the Arthur Hoyt Scott Foundation of Swarthmore, Pennsylvania, and has had wide experience in America and in England in practical horticulture. He will discuss the general subject of hedges, materials used, purposes sought, and treatment given to hedges.

March 11, 1939

MR. R. W. OLIVER

Hedges—II.

Mr. Oliver, of the Central Experimental Farm at Ottawa, will discuss hedge problems and materials, presenting the results of novel work on hedges being done at Ottawa. Visitors seeing this work speak highly of the results.

April 15, 1939

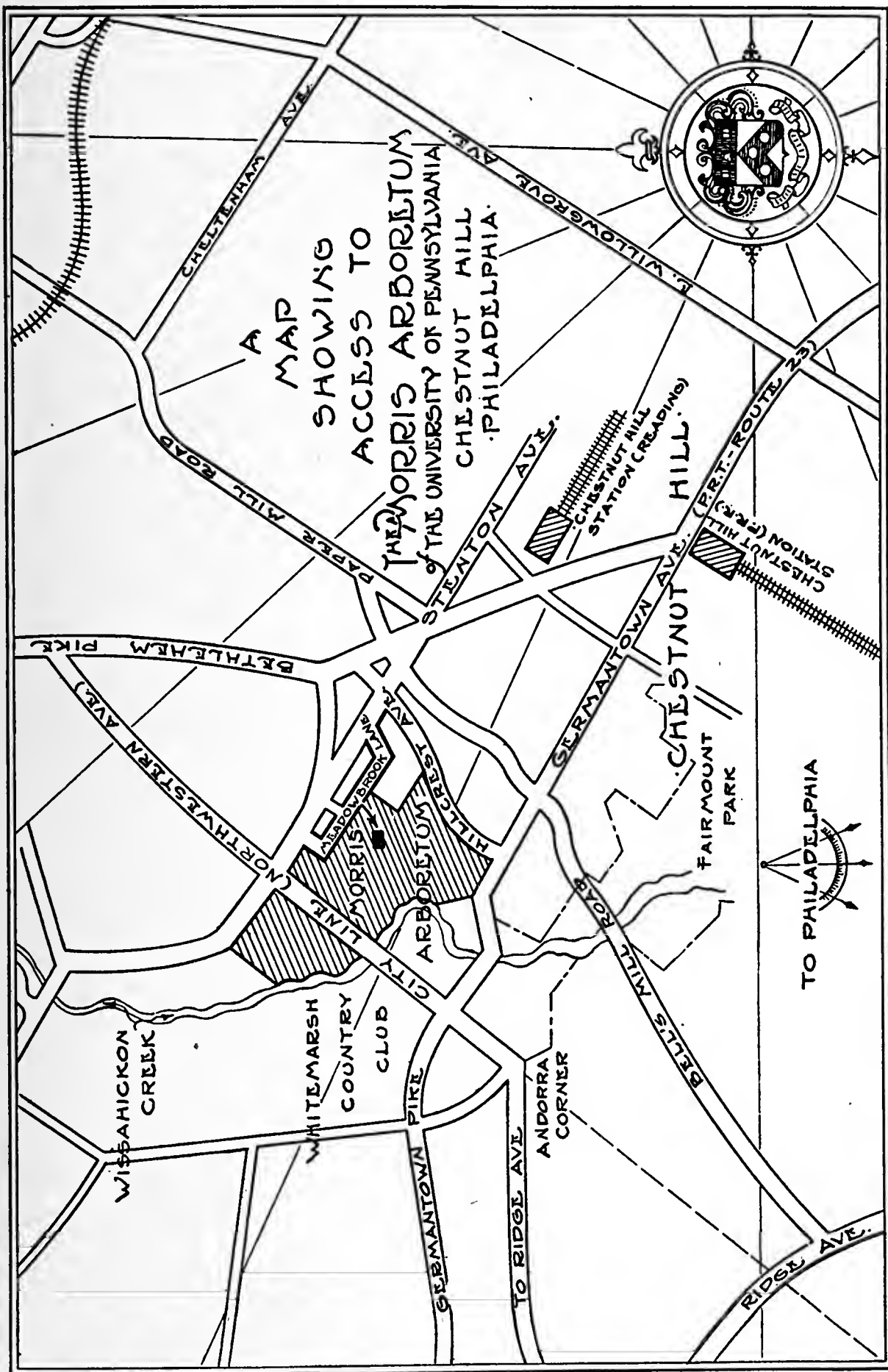
MRS. A. C. BARNES

Cultivation of Hardy Ferns

Mrs. Barnes is Director of the Arboretum of the Barnes Foundation at Merion, Pennsylvania, and has given special attention at the Barnes Arboretum to the cultivation of a very large number of hardy ferns, one of the attractive and novel features of this very beautiful and interesting institution.

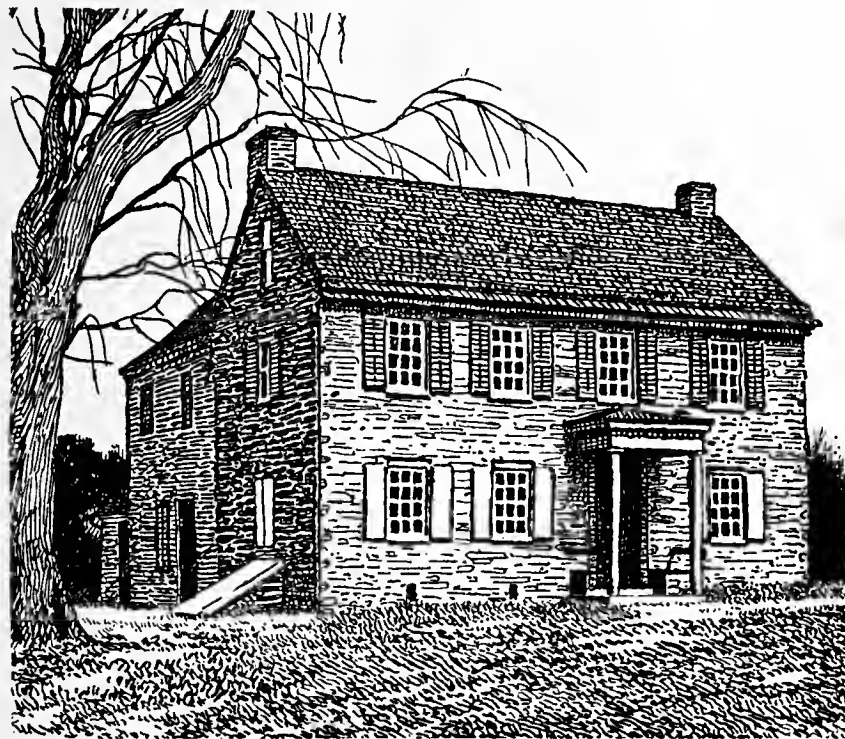
The Arboretum of the Barnes Foundation was started in 1922, when the property was acquired from the late Captain Joseph Lapsley Wilson, who made it a condition of the sale contract that the plantings of trees begun by him in 1887 should be preserved. At present, the Arboretum contains about 1,250 species and varieties of woody plants, including some rare and unusual trees, 250 Lilacs, 245 Roses, Cotoneasters, Barberries, broad-leaved evergreens, etc., which, together with the 88 species and varieties of hardy ferns in the woods, form a collection containing well-developed specimens of decorative as well as horticultural interest.

Lectures will begin at 2:30 P. M. Guests coming in cars will find convenient parking space near the entrance on Meadowbrook Lane.



ARBORETUM BULLETIN
OF THE
ASSOCIATES

APRIL, 1939



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THE
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Sawara Cypress
Chamaecyparis pisifera Eidl.
Var. *squarrosa* Beiss. & Hochst.

ARBORETUM BULLETIN—APRIL, 1939

The frontispiece is a specimen of Sawara Cypress (*Chamaecyparis pisifera* Endl. var. *squarrosa* Beiss. & Hochst.) growing in the Arboretum south of the Mansion. It is a Japanese evergreen introduced into America in 1843 (Rehder). The tree forms a rather narrow upright top, dense, with horizontal or twisted lower branches. The reddish-brown bark peels off in narrow strips. The rather dense top has a light, feathery appearance and bears glaucous green leaves. The leaves are spreading, flat, linear, rather soft, and are about $\frac{1}{4}$ to $\frac{1}{3}$ of an inch long. The dark-brown cones are rounded, about $\frac{1}{4}$ to $\frac{1}{3}$ of an inch in diameter, and bear broadly-winged seeds.

This species has many variations in color and form that are very decorative. It is hardy as far north as New England.

The cover drawing represents the "MILLER'S HOUSE" near the mill on the Wissahickon, "Bloomfield Farm" section of the Arboretum.

The drawing and photograph were made by Gustave Liebscher.

GRASSES*

— BY —

DR. E. M. GRESS

THE STATE OF PENNSYLVANIA is rich in its grass flora, approximately 250 species being now known to science. This abundance of types is in part due to the great variety of climatic, geological and topographical conditions to be seen in the State. With the glaciated areas in the northeastern and northwestern corners of the State, with sandy lake shores of Presque Isle and on Lake Erie, with coastal plain conditions in the extreme east, the basis is formed for a varied ecology. With extensive river valleys following different trends of the compass, with continued wet conditions in the Poconos and in the northern part of the State providing bogs and marshes, with the great mountain ridges offering their varied exposures to light and moisture, and, last of all, the great fertile farming areas, it would be expected that not only the grasses, but other plants as well, would be represented in rich variety in Pennsylvania.

The botanist is happy over such rarities with long Latin names as *Triplasis purpurea*, found only in the sand along the coast, on Presque Isle and around Lake Erie, with *Panicum verrucosum*, another coastal plain species, with *Sporobolus heterolepsis* on the Serpentine Barrens near Nottingham in Chester County, and with *Melica purpurascens*, north of Ole Bull Park in Potter County. The number of rarities with equally long Latin names for the scientist could be much extended.

USES

However, for most of us the grasses are chiefly significant because no other family of plants furnishes mankind throughout the world so much food as does the lowly grass family.

In this country, the mind turns instantly to the Wheats as one of our most important food grasses. Originating in the Old World, this group has become one of our mainstays. It is said, moreover, to have given its name to the newly discovered continent before the grain itself had come to the New World. *Emmer*, one of the ancient wild wheats, is said to have been modified into *Amerigo*, first name of the man for whom the new continent, America, was named. Thus, America might be called the "land of wheat."

Another important food grass, native in the New World, is Maize, Indian corn, already cultivated and named by the Indians when Columbus discovered the "land of wheat." Maize is one of our most important forage crops for livestock,

*Abstract of lecture given at the Morris Arboretum on December 10, 1938.

both for the grain and for the dried fodder made from the tops. This great grass is perhaps the most important food contribution that America has given to the world. Millions find it a part of their daily bread.

Members of the *Sorghum* tribe of the grass family serve a variety of uses. Sugar cane competes with the sugar beet to sweeten our coffee and to furnish an important item of nutrition. Broom corn contributes to cleanliness and good order in the house. Sudan and Johnson grasses furnish hay forage.

One hardly needs to be told that an eastern grass, Rice, feeds perhaps half of the people of China, and those of other eastern Asiatic countries.

Other grasses important throughout the civilized world are the ancient grains—barley, oats, rye and millet.

Important as sources of hay for the domestic animals are timothy, blue grass, and a host of other species.

The Bamboos are a most valuable part of the grass family in Japan and other lands, where furniture and even houses are built of bamboo, to say nothing of a host of less important uses. The young, tender shoots are eaten as a vegetable like asparagus.

For many parts of the country, some of the worst weeds in farm and garden are Quack Grass and Foxtail, while Crab Grass invades lawns and golf grounds.

Among the most important manufactured products are those obtained from the grains and grasses. Starch, alcohol, glucose, paper and wall board begin an endless list.

GROSS ANATOMY

The discussion of the structure of grasses was illustrated with slides.

The root system is generally fibrous and lives in the top soil. Some of the larger species, like Indian corn, form proproots that brace the plant against winds. These cord-like proproots are found at the joints of the stem near the ground, and grow obliquely into the soil.

The stems or culms are made up of solid joints or nodes, where the leaves are attached, and the spaces between the joints, internodes, are usually cylindrical, or less often, flattened. The interior may be filled with pith, as in maize, or be empty as in the bamboos, wheat and oats.

The leaves have a sheathlike base that wraps around the stem and gives off the leaf blade that is the conspicuous, spreading part of the foliage. Other structures were pointed out that are important to botanists in classifying the grasses.

Most important are the *flower parts*. These are seldom large and showy, as in many of the higher plants, and require close study because of their small size. The parts representing the calyx and corolla are minute and easily overlooked. The grasses have the stamens and pistils required for sexual reproduction, for seed formation, but again, these are not striking in appearance and are often overlooked. The dangling stamens, usually three in number, are most readily seen in the early morning, as are the feathery stigmas.

In some grasses the flower is perfect in bearing the stamens and pistils in the same flower. Sometimes the stamens and pistils are borne in different flowers on the same stem. Such an arrangement is seen in the Indian corn, the tassels bearing the many stamens in clusters at the top of the stem, while the cob with the long protruding styles and stigmas—the so-called “silk”—represent the fruit-bearing structure. Such a plant is *monoecious*.

In the Buffalo Grass of the western prairies, the staminate (male) flowers are borne on different plants from those bearing the pistillate (female) flowers. Such an arrangement is *dioecious*.

The inflorescence consists of groups of flowers borne in characteristic arrangements as spikes, racemes and panicles.

PASTURE AND LAWN GRASSES

While about 250 species of grass are known to science in Pennsylvania, only a few sorts are cultivated or even domesticated. The wild sorts made up a large part of the low vegetation seen on uncultivated lands, in marshes or in forests.

For *pastures*, the grass must be strongly rooted in the soil in order that grazing animals may not pull it out of the ground. It must have buds, stems or other structures located near the ground, or in it, from which new growth may be developed to replace what was torn off by the animal. It must be nutritious and not too tough.

Perhaps grasses appeal to urban residents most strongly as *lawn* plants. The lawn is the background and filler for the picture made by the bright colors and attractive designs imbedded in it.

For lawn purposes most of the qualities needed in pasture grasses are important. The lawn mower replaces the grazing animal. The grass must renew itself and be enough of a monopolist in its habit and growth to exclude competing weeds and less desirable species of grass.

Here, obviously, there is room for care in selecting the kinds of grass to be used. There is but a small number of species in actual use. Kentucky blue grass, red top, the bent grasses and the fescues form the mainstay of lawn makers.

GRASSES FOR LAWNS*

— BY —

DR. JOHN MONTEITH, JR.

United States Department of Agriculture

THE POPULAR INTEREST in beautifying homes and public grounds with lawns and gardens has been steadily increasing coincident with the increasing amounts of leisure time available to the American public and the increasing interest in out-of-doors recreation. Many persons are now combining their out-of-door activities with construction work on the grounds about their homes. If space does not allow for both grass and flowers, it is usually the lawn which receives first consideration.

As compared with the improvements which have been made in flowers and shrubs, there has been little advance in the selection of strains and varieties of lawn plants which may be particularly well adapted for special uses or for various conditions of temperature, moisture and shade. Lawns have been planted with a lawn grass mixture and have been expected to take care of themselves if given the routine cutting, rolling, watering, and possibly some weeding.

Very little choice of plants is open to the home owner who is interested in developing an attractive lawn. With some 1500 species of grasses native to this country, one might think there would be a wide choice for turf purposes. Our native species, however, will not tolerate the close cutting and other cultural conditions demanded by our turf practices. Only one of them, buffalo grass (*Buckloë dactyloides*) is commonly used for turf purposes, and it is used only on the western prairies. Most of the grasses we use for turf are species that have been introduced from Europe.

In selecting grasses for turf purposes there is not a large list of species from which to choose.

For general lawn purposes in the North, one can wisely limit himself to a mixture of Kentucky bluegrass (*Poa pratensis*), Chewings red fescue (*Festuca rubra* var. *commutata*), redtop (*Agostis alba*) and Colonial bent (*Agrostis tenuis*). Under most circumstances Kentucky bluegrass can make up from 68 to 80 per cent of the mixture. For well-drained shaded areas, particularly well up North, the mixture should contain at least 50 per cent of red fescue. For shaded areas which are poorly drained, rough bluegrass (*Poa trivialis*) should replace the fescue. Ryegrass may be used to give a quick cover, but it should be regarded as a temporary grass which is ordinarily not desirable where a good stand of the permanent grasses can be obtained.

*Abstract of lecture given at the Morris Arboretum on January 14, 1939.

In the South, the choice of permanent grasses is even more limited—to Bermuda grass (*Cynodon dactylon*), Carpet grass (*Axonopus compressus*) and Centipede grass (*Eremochloa ophiuroides*). These grasses grow during the summer months, and become more or less dormant during the winter. Under such conditions, ryegrass is planted in the late fall to give the lawn a green covering during the winter months.

Among lawn grasses at the present time there is no such thing as a commercial supply of seed of a variety or a species developed to meet any particular set of requirements. This is not because of any lack of variability within the grass species. It is merely because no improvement work has been carried on with lawn grasses on a commercial scale.

There are available a limited number of successful strains or varieties of creeping bent, such as Washington and Metropolitan, which have been selected for the special requirements of putting greens. These do not develop true to type from seed, however, and must be grown by the vegetative method from stolons. Moreover, they are not suitable for lawn purposes, unless they can be given the constant attention which they demand. There is no reason, however, why the discriminating home owner cannot have a fine bent lawn if he is willing to spend somewhat more time and money, which are necessary to keep the bent grasses growing in healthy condition.

Although Kentucky bluegrass, for example, makes up such an important part of the grass seed mixtures for our Northern lawns, improved strains have not been developed commercially. Bluegrass is used both for pasture and turf plantings, and yet there is no choice of varieties on the market. The farmer when he buys seed for his pastures or hay fields may receive it out of the same bag from which seed is sold for a lawn grass mixture.

There are variations in quality in different commercial bluegrass seed, but these are not varietal differences. Seed varies in size and weight, in percentage germination and in weed seed content. It is these variations which are responsible for the different grades of lawn grass seed on the market. The better seed produces better turf, so it is well worth the usually small additional cost to obtain seed with the highest percentage of germination and the minimum content of weed seed.

It was because of this lack of varieties available commercially for special purposes and sets of conditions that the selection and development of particularly desirable strains of bent and bluegrass were begun some years ago by the United States Golf Association Green Section.

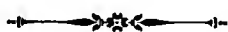
It is evident in any turf that there are certain individual plants which seem to withstand close cutting particularly well, to be particularly resistant to disease, or to exhibit some other particularly desirable characteristic.

In Kentucky bluegrass we are particularly interested in selecting for ability to spread and make a dense turf, for durability and ability to withstand close cutting, for resistance to leafspot and other diseases, and for ability through vigorous growth to compete successfully with clover and other weeds. If these characteristics can be combined with fineness of texture and ability to hold good color, we will have the ideal strain of bluegrass for turf purposes. Such a grass, however, would not give a sufficient heavy yield of forage to be highly rated as a pasture or hay grass.

For several years individual plants have been selected and propagated vegetatively. Also the plants have in some instances been self-pollinated. The result is that at the present time there have been developed on our plots at the Arlington Turf Garden decidedly superior strains of Kentucky bluegrass.

These methods are similar to those which have been used successfully for many years by the Green Section in developing new and superior strains of creeping and velvet bents. Notable among these selections are the Washington and Metropolitan strains of creeping bent, which are used so widely on golf greens in this country.

In recent years, this selection work has been continued with the result that many new strains have been developed and tried out, not only on the turf garden plots, but also on greens in various sections of the country. Many of these are fine in texture, hold up well in color, and are resistant to "brownpatch," to "dollarspot" and in some cases even to insect injury. The better strains are now being tried out on greens for durability under the trampling and heavy play which a grass must successfully withstand if it is to be used on the golf greens. They have been planted on various greens throughout the country and this year will be planted in still more sections, in order to determine the range of climatic conditions which they will tolerate. Some of these strains have promise also as lawn grasses, which will be easier to maintain than the varieties of creeping bent now on the market.



MORE TREE DISEASES

RECENT NUMBERS of the *Plant Disease Reporter*, issued by the Division of Mycology and Disease Survey, Bureau of Plant Industry in the U. S. Department of Agriculture, contain discouraging news for tree lovers.

The issue of February 15, 1938, reports the occurrence of Witch's Broom of Black Locust, *Robinia pseudacacia*, in mild form in Pennsylvania and Ohio; in severe form in Maryland, District of Columbia, Virginia, Tennessee and North Carolina. This has not been found in New England or in New York.

The American White Elm is reported to be suffering from a virus disease that has been discovered in places in Ohio, northern Kentucky, southern Indiana and Illinois. Seen first as a city disease, this trouble has been found in forests in West Virginia. The onset of the disease is marked by a slight wilting and brittleness of the leaf. The roots and the inner bark rot and death follows soon.

The fungus causing the Dutch Elm Disease of this tree has been isolated in a living condition from the bodies of two kinds of elm bark beetles in areas where trees affected by the disease had previously been found and removed.

A serious disease of the London Plane Tree, so much planted in Philadelphia and vicinity, is reported to be spreading to the southward. In Philadelphia and nearby New Jersey, more than 7000 trees are reported to have died. Baltimore has lost more than 700 trees, and the disease is known to be in Washington, D. C.



PLANT DISTRIBUTION

— BY —

MORRIS ARBORETUM, UNIVERSITY OF PENNSYLVANIA

THE PLANTS listed below are ready for distribution to Associates of the Arboretum. All are trees or shrubs, many having distinct ornamental value. The supply in cases is limited. If it can be arranged, Associates are urged to visit the Arboretum and make selections. It is hoped that members may take their plants with them. Plants going beyond the Japanese beetle quarantine must have all soil removed from the roots.

***Amorpha fragens*, Sweet — M1470**

A native deciduous shrub having compound leaves and purple-blue flowers.

***Amorpha fruticosa*, Linn. — M5395**

A native species similar to the above.

***Benzoin aestivale*, Nes. — M6674**

The native Spice Bush. An upright, slender, deciduous shrub, bearing yellow flowers in spring and scarlet fruits in the autumn.

***Berberis Wilsonae subcaulialata*, Schneid. — M6815**

Deciduous or half-hardy shrub of Chinese origin.

The following varieties of Boxwood represent plants propagated by cuttings from the original Arboretum specimens. These plants have withstood severe low temperatures without artificial protection, and should therefore be hardy.

***Buxus sempervirens angustifolia*, West. — M364**

The leaves generally are lance-oblong shaped.

Buxus sempervirens Handsworthii, K. Koch — M357

An upright form having larger, dark-green leaves.

Buxus sempervirens marginata, Loud.

A yellow-edged foliage variety.

Buxus sempervirens rotundifolia — M350

A sturdy, dark-green type of doubtful origin.

Buxus sempervirens suffruticosa, Linn. — M376

A compact form known as "Edging Box."

Celtis occidentalis, Linn. — M4624

A native deciduous tree known as the Hackberry; bears orange-red to dark-purple fruits.

Chamaecyparis Lawsoniana, Parl. — M7834

The Lawson Cypress, a native evergreen tree of great beauty.

Chamaecyparis pisifera squarrosa, Beiss. & Hochst. — M1127

A glaucous, blue-green color form of the Sawara Cypress.

Cotoneaster acutifolia, Turcz. — M5432

A slender, spreading, deciduous shrub bearing pale pink flowers and small black fruits. A Chinese species.

Cotoneaster acutifolia villosula, Rehd. & Wils. — M5431

A Central and Western Chinese variety of the above species.

Evodea Henryi, Forst. — M4333

A small, deciduous, spreading tree having compound leaves. A native of Central China.

Hypericum densiflorum, Pursh. — M235

A small, slender, upright, deciduous shrub bearing a profusion of small yellow flowers. A native species.

Hypericum patulum, Thunb. — M4408

A low, spreading Japanese shrub bearing an abundance of small yellow flowers.

Ilex verticillata, Gray — M5466

Seedling plants of our native deciduous holly. A small shrub valued for its decorative bright-red fruits.

Koelreuteria paniculata, Laxm. — M4378

The Japanese Varnish Tree, producing in summer panicles of yellow flowers, and later, conspicuous, bladder-shaped seed pods.

Ligustrum acuminatum macrocarpum, Schneid. — M4369

A Japanese upright, deciduous shrub, bearing large, black shiny fruits.

Ligustrum medium (ovalifolium), Fr. & Sav. — M228

A dwarf type of doubtful origin.

Ligustrum ovalifolium variegatum, T. Moore

A variegated form of the California privet.

The following list of "Bush Honeysuckles" are deciduous, upright, flowering shrubs of ornamental value:

Lonicera notha carnea rosea — M4910

Lonicera tatarica latifolia, Loud. — M4833

Lonicera tatarica Leroyana, Rehd. — M4919

Malus pumila Niedzwetzkyana, Schneid. — M1735

An interesting reddish-flesh-colored crab apple of southwestern Siberian and Turkestan origin.

Neillia sinensis, Oliv. — M469

A graceful, slender, branching, low, deciduous shrub bearing pink flowers. A Central Chinese species.

Pinus excelsa, Wall.

The Himalayan Pine. A handsome pine of pyramidal habit, with wide, spreading branches and drooping foliage.

Populus Maximowiczii, Henry. — M4301

A handsome hybrid poplar of vigorous growth and wide, spreading branches.

Populus nigra betulifolia, Torr. — M4309

A variety of the black poplar—of good form.

Populus trichocarpa, Torr. & Gray. — M5956

The Western balsam poplar.

Rhamnus crenata, Sieb. & Zucc. — M1489

An oriental deciduous shrub bearing red, changing to black fruits.

Rhamnus infectoria, L., "Avignon Berry" — M5513

A spreading deciduous shrub native to southern Europe.

Rhododendron arborescens, Torr. — M5517

A native deciduous shrub bearing white or pinkish fragrant flowers.

Rhododendron japonicum suringar x *R. molle* — G. Don — M5520

A salmon-pink flowering, deciduous "Azalea" hybrid.

Rhododendron obtusum amoenum, Rehd. — M7321

An evergreen spreading low shrub bearing small leaves and magenta flowers.

Rhododendron obtusum Hinodegiri — Hort.

Somewhat similar to the above, but having large leaves and red flowers.

Rhodotypus scandens, Mak. — M4549

A deciduous, spreading shrub having large white flowers followed by black fruits. A native of China and Japan.

Salix cordata, Muhlenb. — M6589

One of our native shrub willows.

Salix Matsudana tortuosa — M3159

A small tree of slender upright and twisting branches with green bark.

Salix purpurea amplexicaulis, Boiss. — M528

A native of Europe, Asia and Africa.

Securinega ramiflora, Muell. — M4703

A deciduous shrub having slender arching branches of graceful form; of Asiatic origin.

Spiraea Lenneana — M5907

A free flowering garden form producing dense panicles of rose-colored flowers.

Spiraea salicifolia x *S. superba* — M5916

An interesting hybrid between a European and Asiatic species having rose-colored flowers.

Spiraea sanssoucieana, K. Koch. — M5918

Another garden hybrid of upright habit and floral beauty.

Staphylea pinnata, L. — M4552

An upright, deciduous shrub having greenish-white flowers and inflated fruits.

Symphoricarpos orbiculatus elongatus, Hort. — M5920

A varietal form of the Indian current—a good ground cover.

Syringa japonica, Decne. — M4960

The Japanese lilac. A small tree valuable for its late blooming season.

Thuja occidentalis globosa, Gord. — M4778

A compact globose form of our native American Arbor-Vitae.

Viburnum dilatatum, Thunb. — M5546a

A Japanese upright bushy deciduous shrub having numerous flowers followed by scarlet fruits.



FINAL WINTER LECTURE

April 15, 1939

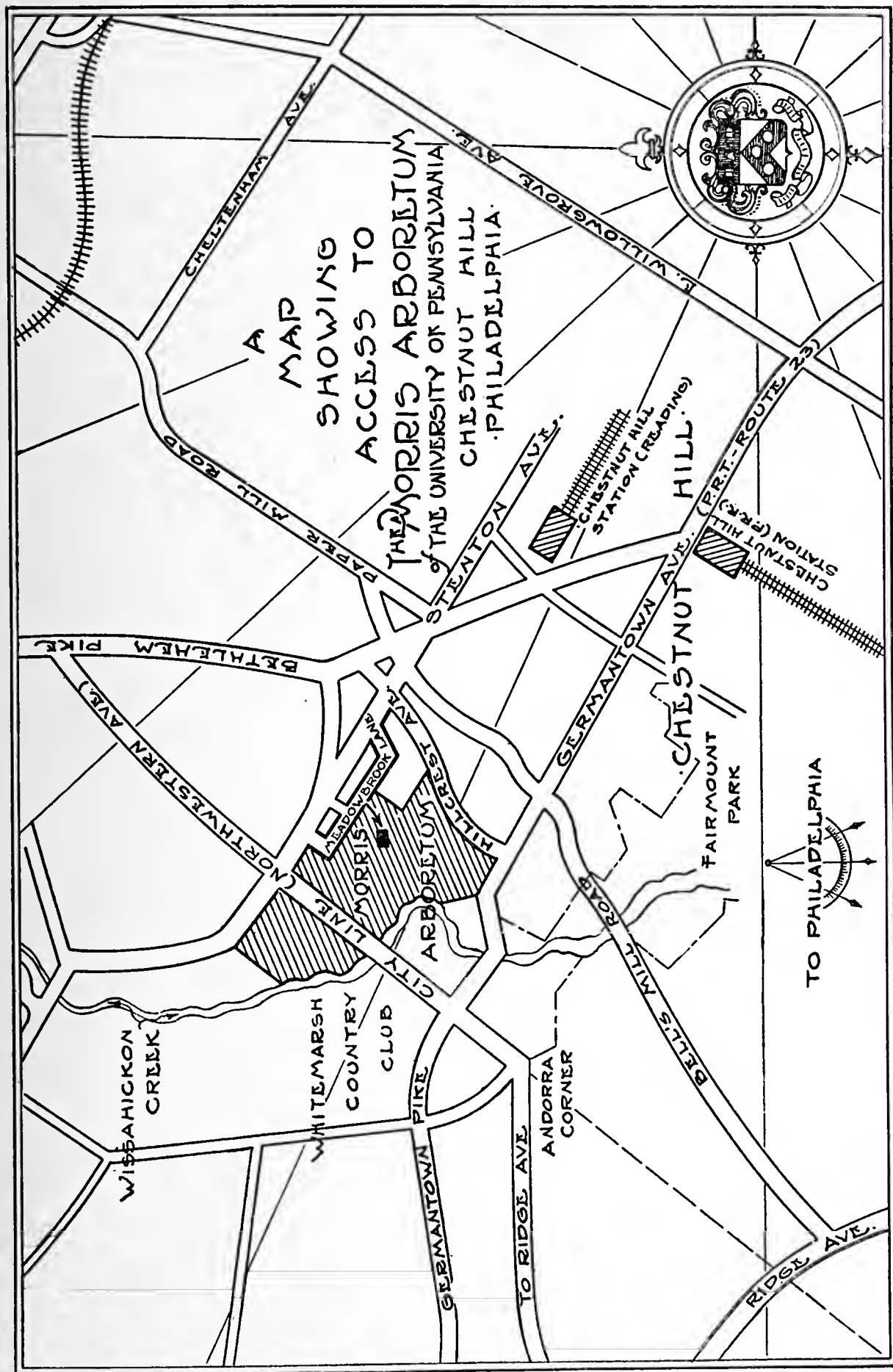
MRS. A. C. BARNES

Cultivation of Hardy Ferns

Mrs. Barnes is Director of the Arboretum of the Barnes Foundation at Merion, Pennsylvania, and has given special attention at the Barnes Arboretum to the cultivation of a very large number of hardy ferns, one of the attractive and novel features of this very beautiful and interesting institution.

The Arboretum of the Barnes Foundation was started in 1922, when the property was acquired from the late Captain Joseph Lapsley Wilson, who made it a condition of the sale contract that the plantings of trees begun by him in 1887 should be preserved. At present, the Arboretum contains about 1,250 species and varieties of woody plants, including some rare and unusual trees, 250 Lilacs, 245 Roses, Cotoneasters, Barberries, broad-leaved evergreens, etc., which, together with the 88 species and varieties of hardy ferns in the woods, form a collection containing well-developed specimens of decorative as well as horticultural interest.

The lecture will begin at 2:30 P. M. Guests coming in cars will find convenient parking space near the entrance on Meadowbrook Lane.

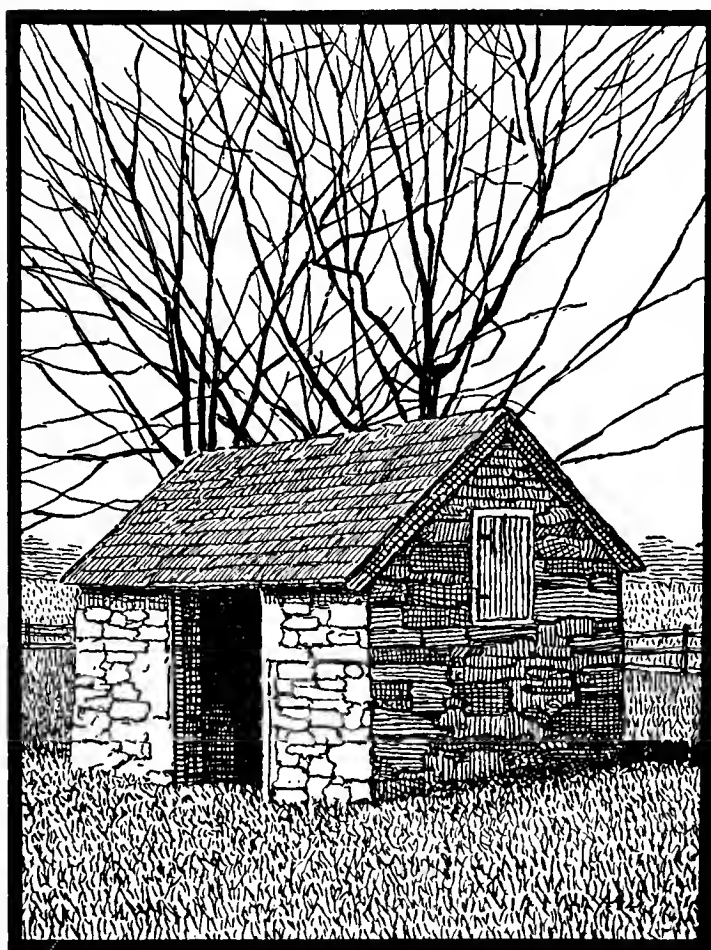






ARBORETUM BULLETIN
OF THE
ASSOCIATES

—
JULY, 1939



THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

Vol. 2 No. 16

MORRIS ARBORETUM
CHESTNUT HILL
PHILADELPHIA, PA., U.S.A.

See
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THE MORRIS FOUNDATION
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THE
MORRIS ARBORETUM
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Cedar of Lebanon
Cedrus libanotica, Link.

ARBORETUM BULLETIN, JULY, 1939

The frontispiece of this number represents a specimen of the Cedar of Lebanon, *Cedrus libanotica*, Link, growing near Hillcrest Avenue at the Morris Arboretum. This tree belongs to the flora of Asia Minor and Syria, where it grows as an upright or somewhat spreading tree, with dark-green leaves. Its cones are from four to five inches across, brown in color, with scales about 5 c.c. wide. It is hardy up to southern New England, and exhibits many horticultural variations. It was introduced into this country in 1680 (Rehder), and has a special interest because of its scriptural associations.

The cover illustration represents the old stone "BLACKSMITH SHOP" near the Mill on the Wissahickon.

The photograph and the drawing were made by Gustave Liebscher.

HEDGES*

—BY—

MR. HARRY WOOD, *Superintendent*
Arthur Hoyt Foundation, Swarthmore College

History

INTEREST IN GARDENING, particularly in ornamental horticulture, has increased tremendously in America during the last twenty years, due no doubt to the growth of the garden clubs. Unusual plants of every description and great beauty have been introduced to American gardens. The desire to own a home in the country or suburbs has been instrumental in creating enthusiasm in gardening. Every new home, no matter how small, has been planted in some manner, perhaps not always to the best interest of the surroundings, but nevertheless an effort has been made to improve the property. To this new interest may be attributed the demand for new and better hedge materials. Although the use of hedges is not new, comparatively few species have been used for this purpose.

A hedge is a living green fence designed for protection or ornament as well as a thing of beauty, changing with the seasons of the year, with different color hues and bloom. Hedges have been used by farmers in England for hundreds of years, as a protection against encroachment by stock over their land. The prosperous farmer uses the method of crop rotation. Generally, once in five years he plows his lea field (sod) which is usually enclosed by a hawthorn hedge, planted on a mound of earth about three feet high. Before plowing the field the hedge is felled. By this I mean the upright branches are cut part way through and laid down and woven in (the cut in the branches is generally made about 2½ ft. from the base). Along the hedge all surplus wood is cut out. When growth starts, the young shoots break from the lateral buds, which grow up in a vertical position, thus forming a new hedge. During that year not much attention will be needed except for an occasional slashing to keep any vigorous new growth under control. The following year the hedge is slashed on each side with a long hook. This method is continued each year until it is time to fell again. It will be readily seen that this is not a very expensive method, but the result is an almost impregnable hedge which is a thing of beauty. Probably the most widely used hedge plants on the farms of early American settlers were the Honey Locust and Osage Orange. The Osage Orange is still used extensively, but its unfortunate susceptibility to San Jose scale has reduced its popularity of late. The English and some of the native hawthorns have been used without great success. The advent of the wire fence no doubt brought about the abandonment of hedges as a protective fence in this country.

With the development of the large estates in England, the hedge was used to emphasize garden design, as a screen, and to give a foundation for topiary work. The yew and boxwood were used much more extensively than any other plant. The advantage of these plants was their adaptability to almost any situation. They could be trimmed to any design, as is in evidence today in the old hedges that have been in use for a couple of hundred years. The desire for privacy even in the small cottage

*Lecture given at the Morris Arboretum on February 11, 1939.

garden was unquestionably the reason for such universal use of the hedge.

In most parts of the world, man's selfish nature disposes him to fence out the intruder. However, hedges have many other qualities for which they can be recommended. Used intelligently, hedges make the landscape more attractive, provide shelter for more tender plants in the garden, enable the home owner to screen objectionable views from his garden, serve as a line of division between service yard and formal garden, prevent persons from cutting across corner lots, and stop animals from overrunning the property.

Planting and Care of Hedges

Deciduous plants are in best condition for transplanting when dormant. In this way they can be planted with bare roots. If the ground is in good condition this can be done as early as March 15th to April 30th. Species that commence growth early in Spring, Lilacs for example, should be planted in the Fall. In this district, planting of deciduous shrubs may be done until Thanksgiving.

The planting of evergreen hedges should be completed about October 15th, thus allowing them sufficient time to make some root growth before severe weather sets in. Planting of evergreens can be continued all winter, but the best time to do the job is from April 1st to May 10th, and September 1st to October 15th. Evergreens must always be planted with a ball of earth.

Hedges should be planted in well-drained soil and in a sunny location. Planting in the shade, except for a few species, is one of the chief reasons for a straggly appearance.

Hedges should be given plenty of room for development. This fact should be taken into consideration when planting a hedge on a property line, border or walk. The distance between the plants must necessarily be governed by the size of the plant used. This may vary from 12 inches for barberry or privet to 36 inches for the more expensive evergreens. The *ground* in which the hedge is to be planted should be thoroughly *prepared*. Presumably the hedge is expected to stay in the location a good many years. Therefore, do not be too economical in the use of good manures. The ground should be trenched at least two feet deep. The width should be governed by the type of hedge to be planted. A large hedge will need a prepared area at least four feet wide, a smaller hedge about 18" to 2'. The manure should be well mixed with the soil during the trenching operation. Before planting it is advisable to allow the ground to settle. In planting a deciduous hedge, dig a trench allowing sufficient room to spread out the roots, fill in the soil, shaking it around the roots and firm well. When the operation is completed the soil should be about an inch below the level of the existing grade. After watering, a mulch of well-rotted manure should be applied, thus preventing evaporation.

Deciduous hedges should be cut back almost to the ground after planting. Plants treated in this manner will form a compact hedge from the beginning.

Care after planting is of great importance. During the first Summer after planting, particular attention should be given to watering. Should the hedge show evidence of the need of fertilizer, an application of well-rotted manure, dug under the surface, or a complete fertilizer may be applied. A hedge that is growing under the right conditions both as to soil and location, should not need any fertilizing for some years.

It will also be necessary to keep a sharp lookout for pests that prey on hedge plants—such as scale, red spider, bagworms, etc. These can all be controlled quite easily and inexpensively if the right precautions are taken, spraying at the proper time and with the right materials.

Most deciduous hedges require trimming but once a year, except California privet and Osage Orange, which need to be trimmed more frequently.

Pruning shears are preferable to hedge shears for many plants, particularly those with broad foliage. It is a more costly operation, as hedge shears would do the job so much more quickly but unfortunately the foliage would be marred as many of the fine leaves would be cut into small pieces, thus spoiling the real beauty of the hedge. On a hedge of Forsythia, Lilac or Spiræa, all or most of the blooming wood will be sacrificed if cut to any rigid shape. This type of hedge plant is best treated as naturally as possible, planted in a position where severe trimming is not required and trimmed only after blooming, removing the old stems. Treated in this way they will give great satisfaction as a hedge and blooming shrub. A Barberry hedge trimmed to a formal shape will be minus its beauty, as all the fruit will more than likely be destroyed.

Trimming evergreen hedges will depend upon the type used, and the kind of hedge desired. Some evergreens need more attention than others. For instance, Arbor vitae will not need as much trimming as Hemlock. The time to trim an evergreen hedge is a debatable question. The Hemlock for instance, is often trimmed in the early Fall. My preference is to trim in the Spring before the new growth starts. This method allows the current years growth to remain all year and give a very graceful appearance to the hedge. Fall trimming does the opposite, removing the new growth and the result is a very formal appearance. The Yews require much the same treatment as the Hemlocks. The more informal evergreens such as Arbor vitae and Japanese Holly, do not need as much trimming to keep them in shape.

Of course the problem of how hedges should be trimmed depends entirely on what is required. If a hedge is to be kept to a small size, naturally it must be trimmed more severely. The question is often asked how much to cut off. This also depends on the hedge, but a general rule is to cut to within one half inch to an inch of the old growth, on the hedge that is full grown. On a newly-planted hedge the amount of cutting will be determined by how fast the hedge is needed to get to desired height. It is poor practice to leave too much young growth, as the result will be a very poor, straggly hedge.

The shape and style of hedges are matters of taste, but one recognized rule is of great importance. The base of the hedge should always be wider than the top, to allow sunlight and air to reach the lower branches and encourage a strong growth from the base of the plant.

The type of hedge plant to be used will depend on what kind of hedge is needed, whether it is to be a screen, or a formal hedge, or whether tall or short. Tests of hedge suitability have been made on many plants. In order to choose from a large number of possible hedge plants a study should be made of the location which is to be developed. Of course all types of hedge plants will lend themselves to formal trimming, but on many of the finer flowering kinds bloom will be lost. Today the proper material can be had for any kind of a hedge, be it tall, medium or low, formal or informal.

HEDGES*

— BY —

R. W. OLIVER

Central Experimental Farm, Ottawa, Canada

WHILE THE COLLECTION of hedges at the Central Experimental Farm at Ottawa is no longer the largest, we feel confident in saying that it had that honour up until a few years ago, and that more different plants have been tried there than anywhere else on the continent. Since the first sample hedges were planted in 1889, one hundred and sixty different species or varieties of plant material have been tested.

After fifty years of such work, we feel confident in recommending a few of the plants which have proved most satisfactory, and are cutting down on our collections to a considerable extent. The collection at Ottawa now contains only sixty hedges, most of them comprised of material which has proved most satisfactory, and which we wish to maintain as a demonstration. A list of excellent species that have been found superior at Ottawa closes this paper.

Among the new introductions still in the experimental stage, we might mention two or three of particular interest: The Truehedge Columnberry (*Berberis Thunbergi pluriflora erecta*) which forms with us an excellent low hedge, particularly for edging, and two sorts with fine foliage hardy on the western prairies—*Prinsepia sinensis* and *Malus transitoria*. The latter has particularly attractive foliage.

The Place of Hedges in the Landscape

Hedges should be to a garden what walls and partitions are to a house. They should give us privacy from without, act as a background to the brighter displays of the garden from within, and separate one garden room from another. Because they are barrier, we require dense and frequently thorny growth and sufficient height to give the feeling, if not the actuality, of privacy. Also, they must fulfill their purpose as a barrier by always ending at a boundary or definite object, around which we cannot see or walk.

The height, colour and texture of a hedge will be governed largely by the size of the property and type of garden which the hedge surrounds. A large garden needs a taller hedge than a small garden. A tall or medium hedge should under ordinary circumstances be mid or dark green in colour, as its purpose is to act as a background to the garden. A golden, gray or red-leaved hedge is too conspicuous under average conditions, and kills the appearance of any plants in the foreground.

Low hedges or borders, which are used only to give emphasis to the design by extending the architectural lines in plan on the property, may be of brighter shades, particularly in formal work or in conjunction with light-coloured buildings of "Functional" design.

*Abstract of lecture given at the Morris Arboretum on March 11, 1939.

The texture or detail of a hedge is largely a matter of coarse and fine foliage and the degree of shininess. Large leaves and shiny ones are seen in more detail than small or dull green ones. Consequently, they have the appearance of being nearer at hand and the tendency is to reduce the apparent size of the space surrounded by such a hedge. A hedge of fine texture and dull green colour, such as *Caragana*, would on the other hand increase the apparent size.

Now as to the practical side of bringing up the hedge in the way it should go:

Soil Preparation, Planting

The soil should always be carefully prepared for a new hedge by digging out a trench about eighteen inches deep, and at least twice as wide as the spread of the roots of the young plants. A liberal dressing of well-rotted manure should be dug into the bottom of this trench and covered with a few inches of well-pulverized sandy or clay loam top soil. When the plants are put in place more of this good top soil is put around the roots and firmly tramped down before being watered liberally.

The plants should be placed in a single row, rather than in a double row with the plants staggered, as has sometimes been recommended. The latter method uses more plants and more space, is harder to trim into a good shape, and always leaves a poor end at a gate or path where any unevenness is noticed.

Spacing

The distance apart at which the plants should be placed will vary with the material used and the height to which we wish the hedge to grow. Erect-growing shrubs like privet and the Truehedge Columnberry, used in a low hedge, should be placed nine inches to one foot apart. More bushy plants, which are to make a taller hedge, will be placed from fifteen inches to two feet apart, but for average purposes eighteen inches apart has proved most satisfactory.

Time to Plant

Deciduous hedges should be planted in the fall as the leaves are about to fall, or in the early spring before the leaf buds burst. Evergreens are planted in September, or just before new growth starts in the spring.

Size of Plant

It is better to use fairly small plants unless one can procure larger ones which have been frequently cut back to make them bushy. Two-year-old plants from seed are excellent for most deciduous hedges and four years for conifers. The first spring after planting, deciduous hedges should be cut down to within a few inches of the ground. If older bushy plants are used, cut them back almost to the base of last year's growth. This causes the plant to throw out numerous new shoots close to the ground. In the case of conifers, cut off only about half of last year's growth. Conifers do not usually put out new buds and foliage from bare wood, and consequently will not stand heavy cutting back.

Trimming

Hedges must be clipped each year to keep them in good shape. Never let a hedge reach the desired height before starting to trim it. This will result in a bushy top on tall leafless stems. A hedge must be built from the ground up, not from the top down.

Time to Trim

The correct time to trim will vary with the locality and the season. In general, hedges should be trimmed when the active period of new growth is about at an end. In the northern states this will be at the end of June or early July for deciduous plants and about September first for conifers. If possible, hedges should be clipped during cool, dull spells of weather as this will avoid tip-burning to a great extent.

The reason for clipping toward the end of the growing season is largely one of economy. Hedges trimmed at this time rarely grow enough to get out of shape during the remainder of the season, and will look untidy for only two or three weeks in June. Spring-trimmed hedges or ones trimmed in late fall will need a second trimming to prevent them from looking shaggy all summer.

Shape

The shape to which a hedge is trimmed has a cultural as well as an aesthetic value. From long experience in our northern climate, hedges should be trimmed so that they are slightly wider at the bottom, which permits more light to reach the lower foliage, and consequently helps to keep the hedge close to the ground. Hedges which are widest at the top or which have perpendicular sides do not retain their lower foliage so well. Flat-topped hedges become laden with snow in winter and frequently broken down, so that a rounded or pointed top is best in districts where the snow fall is heavy.

Fertilizing

Because we desire thick, vigorous growth, fertilizing is advisable. We cannot say it is necessary, because even hedges which receive no treatment other than a very occasional application of barnyard manure still continue to hold their foliage. Yet, proper diet pays here as anywhere else. Where it can be obtained, a top dressing of well-rotted barnyard manure applied in the fall and lightly forked into the surface soil in the spring is quite satisfactory. The application of chemical fertilizer by means of the punch-hole method, as in feeding trees, is also good, and the fertilizer will of course vary with the soil. Hedges require high potash as well as nitrogen to form stocky growth of good colour. Coniferous hedges prefer nitrogen in organic form such as blood meal.

Selecting Material

In selecting material for a hedge, several points must be considered. Many of them will be determined by personal taste; such as, whether we wish to have an evergreen or a deciduous hedge, shiny or dull foliage, coarse or fine texture. Rate of

growth, type of soil and degree of shade or sunshine, moisture or drought, are also to be considered. Last, but not least, is the freedom from diseases and insects. Lilac hedges, for instance, are very subject to mildew, which spoils their appearance. Hawthornes suffer from the ravages of all insects which attack the apple, and may consequently prove a source of infestation in a fruit district. Neither of these hedges, although both are useful, should be planted unless they can be properly sprayed.

Best Hedges

The following hedges have proved most satisfactory at Ottawa, and can be thoroughly recommended wherever they are hardy:

Conifers

White Spruce (*Picea glauca*)
 White Pine (*Pinus Strobus*)
 Japanese Yew (*Taxus cuspidata*)
 Hemlock (*Tsuga canadensis*)

Douglas Fir (*Pseudotsuga taxifolia*)
 Arborvitae (*Thuja occidentalis*)
 Swiss Stone Pine (*Pinus cembra*)

Deciduous, Non-Flowering

Dwarf Barberry (*Berberis Thunbergii*) & vars.
 Canoe Birch (*Betula populifolia*)
 Siberian Pea (*Caragana arborescens*)
 Hawthorne (*Crataegus species*)
 Amur Privet (*Ligustrum amurense*)
 Bush Honeysuckle (*Lonicera tatarica*)
 Common Lilac (*Syringa vulgaris*)
 Hungarian Lilac (*Syringa Josikea*)

Chinese Elm (*Ulmus pumila*)
 Wayfaring Tree (*Viburnum lantana*)
 Beech (*Fagus grandifolia*)
 European Larch (*Larix decidua*)
 Shingle Oak (*Quercus imbricaria*)
 Buckthorn (*Rhamnus frangula*)
 Laurel Willow (*Salix pentandra*)
 Dwarf Siberian Pea (*Caragana pygmaea*)



CULTIVATION OF HARDY FERNS*

— BY —

MRS. A. C. BARNES

Director of the Barnes Arboretum, Merion, Pa.

FERNS GO BACK to the Paleozoic era, fifty-three or more million years ago, and are older than any form of terrestrial vegetation now in existence, as other forms have either ceased to exist or are now so modified as not to be easily identified. They were the all-embracing form of vegetation at one time and formed the base of our coal-deposits, fossil remains of which are often found, proving that they have remained true to form.

Ferns are the third and highest division of flowerless plants in the kingdom, are known as the Pteridophytes, and are made up of twelve families, including the exotic and tropical. These vary in size from hair-like creeping stems and moss-like leaves, to

*Abstract of lecture given at the Morris Arboretum on April 15, 1939.

tall trees eighty or more feet high, and there is no country or region where ferns do not grow, except in absolute desert. There are 6,000 species known to science; 250 species in America and northern Mexico; 75 native American species; about 150 hardy species, with 60 species in cultivation.

Ferns are of little economic importance except as ornamental plants, although they do good in breaking down rock formation to form soil, and also on banks where they hold soil in place, not permitting it to be worn away by water. The starchy rootstocks of some species are eaten locally, as are also young shoots, while a few others are used medicinally. Certain species are of use to florists and horticulturists, and without them the world would lack much of beauty. Thoreau said: "Nature made a fern for pure leaves," and although to many a "fern is just a fern," the many species and varieties, with their differences in color and texture, give us pleasure and enjoyment.

Like other members of this *phylum*, they reproduce by means of spores, runners, or in some instances buds or bulblets, and also tips of the leaves, and it is interesting to note that the method of reproduction was discovered only in the first half of the nineteenth century. Some species, perhaps the majority, prefer an acid soil, but some have a predilection for limestone, growing in crevices or on ledges, while still others prefer granite or sandstone.

For planting purposes ferns may be divided into two classes, the first those having slender branching rootstocks which creep at or just below the surface. These ferns spread rapidly and make large, dense colonies; for example, *Dennstaedtia punctilobula*, the Boulder Fern, or called by some the Hayscented Fern. This fern prefers dry, rocky fields and makes a rather tangled clump. Another fern in this class, *Pteris aquilina* or *Bracken*, spreads rapidly and is hard to eradicate and grows so tall—three to four feet—that it oftens smothers the surrounding planting.

New York Fern, *Dryopteris novaboracensis*, is another fern in this class, but prefers shady, dry places; while still another, *Dryopteris thelypteris* or Marsh Fern, prefers moist, shady places. By moist soil is meant a well-drained soil, not dry, and not one that is marshy or constantly wet. These ferns, and other ferns with running roots, send up fronds a few inches apart all through the growing season. Therefore, they can be transplanted at any time, and should be planted with the roots not more than one inch below the surface.

The second class of ferns, those with thick rootstocks, bear one set of fronds a season in more or less circular tufts rising from the crown only, so that in planting it is necessary to place the rootstock upright and not to bury the crowns, but to plant them just above the surface of the soil, and in every case with the roots spread out in their natural position. All these ferns should be planted far enough apart, so that beauty of foliage and luxuriance of growth may be secured.

Perhaps the best-known ferns in this class are the Osmundas, called the Flowering Ferns, because they have the sporangia at apex or middle of the frond or as a

separate leaf—a sporophyll. These are all tall ferns, which is a point to be considered in planting:

Osmunda claytoniana, Interrupted fern which grows in sun or shade.

Osmunda regalis, Regal or Flowering fern, which prefers a cool, moist situation.

Osmunda cinnamomea, Cinnamon Fern. This will grow in sun or shade and in a fairly dry location.

Another tall fern, *Pteritis nodulosa* or Ostrich Fern, is not particular as to location, but does not last through the summer, as it withers and turns brown by the first of August.

The lasting quality of a fern is also a point to be considered, and another fern that does not last through the season is *Cystopteris fragilis*, one of the Bladder Ferns, but it is dainty and attractive while it lasts. In contrast to it, another Bladder Fern, *Cystopteris bulbifera*, lasts until cut down by frost, and grows in moist or dry locations, in sun or shade. This fern, although it bears spores as freely as any other, also has tiny bulblets in the axils of the pinnules, which, when they come in contact with the soil, put forth roots and are ready to begin life for themselves.

Some ferns are evergreen, e.g., the Christmas Fern, *Polystichum acrostichoides*, used by florists, which has a dark green, leathery texture, and prefers a northern sloping bank.

Polystichum munitum—a native of the west.

Polystichum brauni—Braun's Holly Fern—while not actually evergreen, does last well on in the season, when the rachis bends down from the weight of the rather heavy hairy fronds.

Polystichum aculeatum—similar but smaller than the above.

Dryopteris marginalis—Marginal Fern—easy to grow and delights to nestle among crevices in the rocks.

The *Lastraeae*—*chrysoloba* and *opaca*—not as well known here as abroad, and others in this species, which with us have proved evergreen or almost so.

Another genus, the *Athyriums*, are easy to grow and one known all over the world is the Lady Fern, *Athyrium filix-foemina*, and, with another which resembles it very closely, *Athyrium angustum*, will grow in sun or shade, moist or dry situations. *Athyrium thelypteroides*, the Silvery Spleenwort, is heavier in texture, but grows under any condition, in contrast to *Athyrium pycnocarpon*, Narrow-leaved Spleenwort, which has long, narrow leaves, easily broken down by summer storms, and prefers moist shade, but its dark green fronds are a good contrast to ferns of a lighter color.

In the wood ferns, or genus *Dryopteris*, which prefer shade, there are many of different textures and tones:

Dryopteris filix-mas—Male Fern—grows erect, as does:

Dryopteris cristata—Crested Fern,

Dryopteris spinulosa—Spinulose Shield-Fern, which has finely divided foliage.

Dryopteris boottii, is now classed as a hybrid of the two last mentioned. In the nomenclature of the ferns there has been a great confusion of terms, for besides the common names given in the localities in which they have been found, the botanists have changed the scientific names from one genus to another, and changed the names of the species and varieties as well.

Another *Dryopteris*, *goldiana* or Goldie's Fern, grows four or more feet high, and is equally attractive either as a specimen or in a mass.

Dryopteris viridescens, a native of China and Japan, is most dainty and attractive.

Lygodium palmatum, the Climbing Fern, as well as *Camptosorus rhizophyllus*, the Walking Fern, are among the eighty-nine species and varieties which we are able to grow in normal wood habitat in these parts.

There is no difficulty in growing ferns if care is taken to consider their individual likings as to sun or shade, moist or dry situations, etc. In an order so varied in form and texture there are many standards of beauty, some ferns being at their best when grown as specimens, others when seen in masses. The setting and surrounding planting must be considered, as all ferns require a mulch, about two inches in summer and four inches in winter, and in every case, the roots, and not the plant itself, must be covered, as the fronds, especially in the root-creeping species, form sufficient protection. Ferns should not be planted in a perennial border, as they cannot be cultivated, but this does not mean that flowering plants cannot be associated with them, for many of our woodland plants, from the time of the first blood-root, anemones, primroses, etc., to the fall-blooming asters and cardinal flowers, give us a succession of bright and contrasting colors. Of course, rhododendron, laurel, and our native azaleas, must not be forgotten, as, with the trees, they furnish shade and also add the beauty of their blossoms.

ARBORETUM OF THE BARNES FOUNDATION—List of Ferns Illustrated

Dennstaedtia punctilobula—Boulder Fern

Osmunda claytoniana—Interrupted Fern

Osmunda regalis—Regal Fern

Osmunda cinnamomea—Cinnamon Fern

Pteritis nodulosa—Ostrich Fern

Cystopteris fragilis—Common Bladder Fern

Cystopteris bulbifera—Bulb-Bearing Bladder Fern

Polystichum acrostichoides—Christmas Fern

Polystichum munitum

Polystichum brauni—Braun's Holly Fern

Polystichum aculeatum

Dryopteris marginalis—Marginal Fern

Lastraea opaca

Lastraea chrysoloba

Athyrium filix-femina—Lady Fern

Athyrium thelypteroides—Silvery Spleen-wort

Athyrium angustum

Athyrium pycnocarpon—Narrow-leaved Spleen-wort

Dryopteris cristata—Crested Fern

Dryopteris spinulosa—Spinulose Shield-Fern

Dryopteris boottii

Dryopteris goldiana—Goldie's Fern

Dryopteris viridescens

Onoclea sensibilis—Sensitive Fern

Dryopteris hexagonoptera—Beech Fern

Lygodium palmatum—Climbing Fern

Camptosorus rhizophyllum—Walking Fern

Dryopteris filix-mas grandiceps drevery

TREES AS ENERGY TRANSFORMERS

I SUPPOSE that to most of us who have a fireplace and a woodpile, it is a routine matter when the room is a little chilly and darkness comes on, to start a fire and enjoy the light and heat given off by the burning wood. Perhaps we do not appreciate what we have really done in carrying out this simple program—how deeply we have reached into the affairs of the universe. Let us consider what has taken place.

The sticks of wood were once part of a living organism—a tree—that, like us, needed energy to run its machinery. The ultimate source of energy for us is the sun that from its fiery surface radiates light and heat into space. This radiant energy penetrating our atmosphere supplies this most urgent need felt by all living things. The tree, like other green plants, throughout its life absorbs this energy through its leaves, and by using the green material, chlorophyll, is able to build up its body. The roots absorb from the soil a small quantity of several kinds of minerals dissolved in water, and the leaves absorb carbon dioxide gas from the air.

From these simple and rather stable substances, the living protoplasm is able through the properties of the chlorophyll to use the energy coming from the sun, to break up the molecules of water and carbon dioxide, and to rearrange the resulting materials to form chemical substances in which a part of the sun energy is tied up as potential chemical energy. The body of the tree, increasing in size from year to year as the growth processes continue, becomes the massive trunk and branches that the woodsman cuts down. This woody mass of cellulose has been a storehouse in which an increasing amount of potential energy is put away year by year, to rest in peace until liberated by some suitable agency. Like the beds of coal lying for millions of years in the earth, it holds its captive sunshine.

When we started a fire in the fireplace and reached for the sticks of wood, we again started to dabble in the affairs of the universe. We strike a match, and by so doing turn the chemical energy stored in the match head into heat and light. This is applied to the kindling in the fireplace, which catches the blaze, and in turn heats up the sticks we had laid upon it. Soon the fireplace begins to resemble in an infinitesimal way a part of the sun's surface, giving off light and heat. The energy from the sun that had been caught and held as chemical energy in the wood now is being freed after years in storage.

The fire probably proceeds to its usual end. The gases given off from the heated wood burn for a time as luminous flames. The hot coals glow, and finally only ashes remain, and that part of the story is done.

The sun energy has been freed as light and heat that radiated into space, the water went up the chimney as water vapor, and the carbon dioxide went with it

back to the atmosphere. Only the ash remained, and that probably went back to the earth.

We have had a glimpse of cosmic happenings, and have taken part in one of the commonest human experiences.

RODNEY H. TRUE



ACKNOWLEDGMENTS

The Arboretum is grateful for the following presentations:

EASTERN SHORE NURSERIES

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20 plants of 2 species

A. E. WOHLERT

Penn Valley Nursery, Narberth, Penna.

2 plants of 2 species

HENKELS & MCCOY

Germantown, Philadelphia, Pa.

2 plants of 2 species

U. S. DEPARTMENT OF AGRICULTURE

Soil Conservation Bureau,
Chapel Hill, North Carolina.

43 plants of 19 species

U. S. DEPARTMENT OF AGRICULTURE

Soil Conservation Bureau, Zanesville, Ohio.

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Merion, Penna.

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var. *Sachalinense* F. Schmidt.)

U. S. DEPARTMENT OF AGRICULTURE

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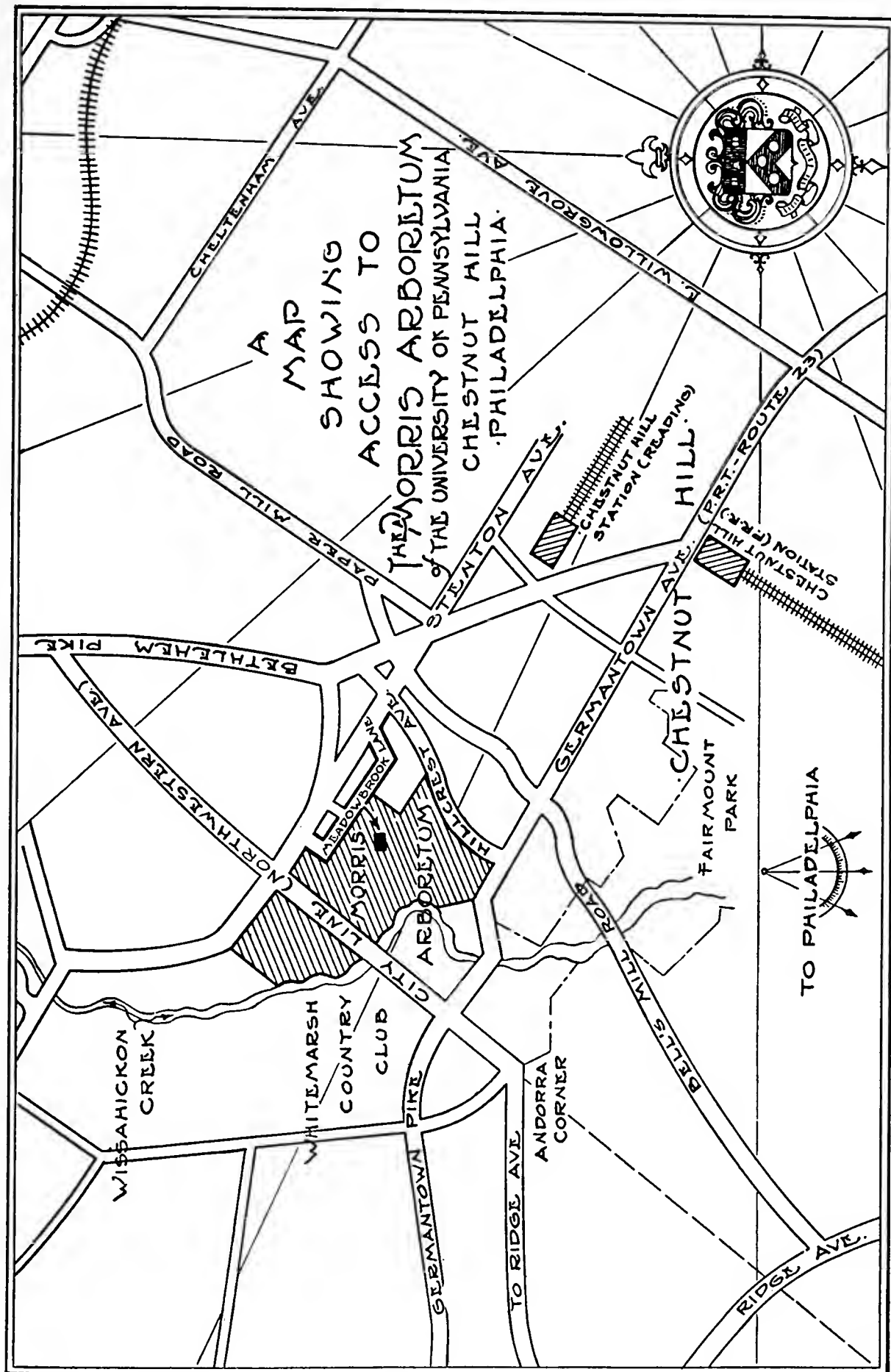
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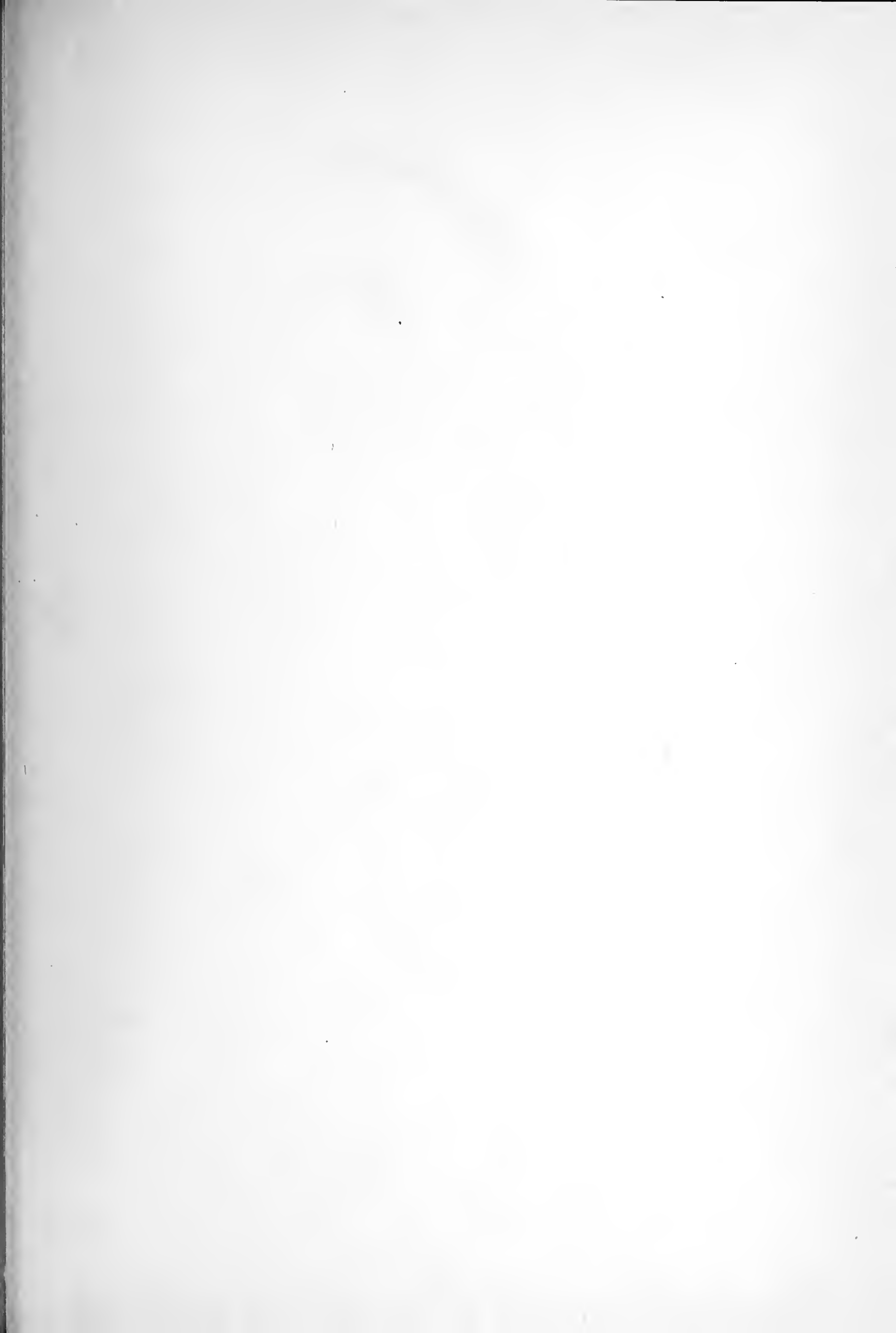
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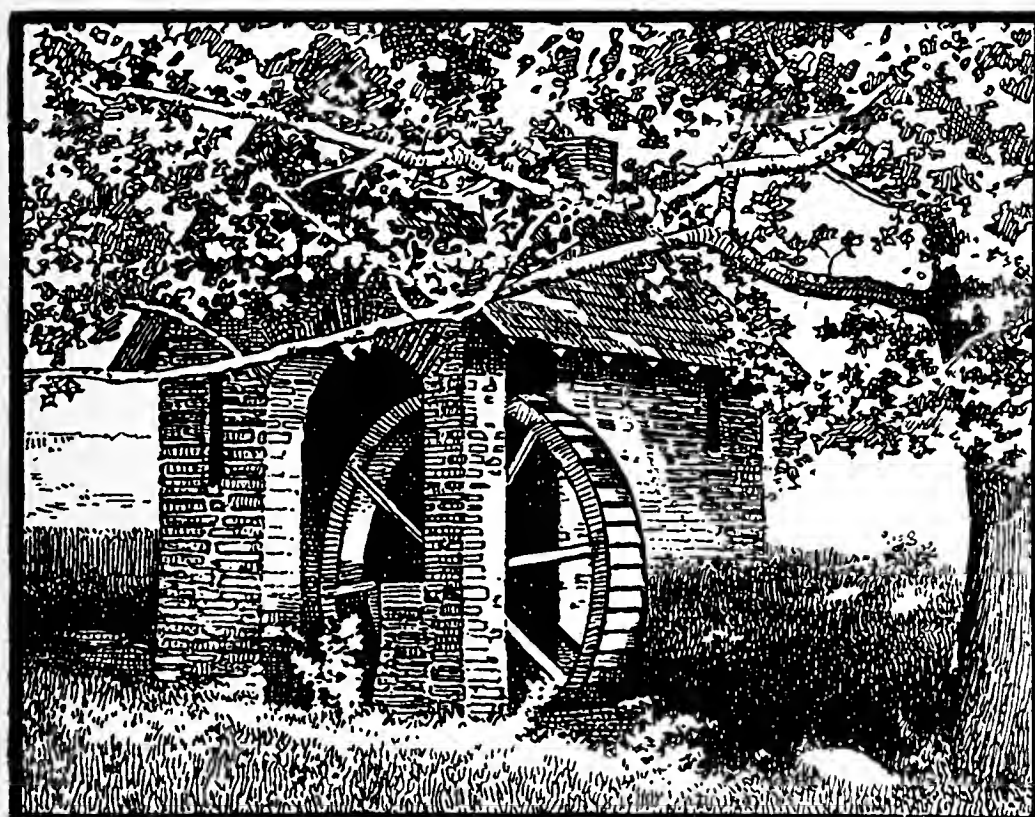
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OCTOBER, 1939



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THE
MORRIS ARBORETUM
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American Holly
Ilex opaca Ait.

ARBORETUM BULLETIN — OCTOBER, 1939

The fine specimen of American Holly, *Ilex opaca* Aiton, shown on the frontispiece, may be found in the Arboretum's Ilex group, about midway between the Mansion and the Swan Pond. In the wild this species is native from Massachusetts to Florida, and west to Missouri and Texas.

It is made prominent in the winter by its spiny and somewhat glossy evergreen leaves, the female tree being brightened by the shining, red, berry-like fruits. Since the sexes are on separate plants, a male tree must grow within reasonable proximity in order that the female may produce the fruits.

Great quantities of the "berry-bearing" branches are shipped to cities and towns for Christmas decorations. This seasonal use makes this species one of the best known and loved of all our native trees.

The cover design represents the Wheel Pump beside the brook flowing through the meadow.

The cover design and the photograph were made by Gustave Liebscher.

"AMERICANS DISCOVERING NATIVE AMERICA"

AMERICA'S TREES are being discovered by the average citizen of America. For long, long years the matter of introducing American trees was attended by a definite indifference to anything native in America. Just see what has been planted on the grounds, campuses and public parks, and you will find exotic trees in greater numbers than native Americans.

To begin with, not long ago I was invited to see the grounds surrounding a very big, new school building. The Committee pointed out to me the spacious lawns, driveways, and walks all finished and the green lawn in full color. And now for the trees, we have made a start said the Chairman, and would I make any suggestion? Yes, said I, but what is the use when already you have started to plant and already you have selected the species of trees. According to your plan, you will have the place outlined with Norway Maples, when right over in yonder woods stand some of the finest trees in this wide world, and they are native to your own state. There, see those wonderful White Oaks now at their height in autumn tints, and there, see that cluster of Magnolias (Sweetbays). Its leaves of silver and emerald color, trees that bloom a long season giving beautiful white and elegantly scented flowers. And close by were several fine Sweet Gum trees in all their many colors, and we could see clusters of Birches and highly colored lower growing trees I could not easily distinguish. Then I saw some real, majestic-sized Holly trees (yes, this place is some distance to the south of Philadelphia and it is no fairy island of the imagination). Now then after seeing this much almost in one breath, I stopped for a moment and then said to the Committee. Would it not be good policy to plant all of these grounds with trees native of your state, so that your children attending school might learn of the real treasures you have in trees. Trees incomparably finer, better and more colorful than any tree that is introduced from any country no matter where. Then, too, these native trees are part of America designated when time began to be part of this America. Before we ended our little conference I saw a most spectacular group of Dogwood in its richest autumn color. I said, it were better that instead of using so many Norway Maples you would use Dogwoods, and you would have in season enough color to have a spring festival when they are in bloom. And you can have another festival in fall when the leaves have turned, and the berries are red and ready for a farewell feast for our migrating songbirds. My! what a story could be told to the children if they were introduced to at least some of our gorgeously beautiful trees. The climax of this meeting?

Well, it has had a good effect; for obvious reasons, I cannot give names of persons nor places.

Last spring I started a number of different times to find early flowering trees that are native (no, I am not prejudiced against exotic trees, but I do want to respect our own as much). It was in April, near the middle of the month, and I looked in particular for a very large Amelanchier tree I knew twenty-five or more years ago. I found the place but the tree was gone, so I just kept on prospecting along any and all little-used country roads when suddenly and to my utter surprise, I saw the most magnificent specimen of a tree just bursting into bloom a little more than a mile off. Excited, yes sure, I got to the tree in short order, and found, I believe, the largest and most perfect Amelanchier tree in all America. The buds just before they open are of a purplish-pink color, snow-white when fully open. I came to see the tree a number of times and have some excellent colored pictures, both in stills and in movies. Now here is its size—the trunk near the ground is two feet in diameter, straight as a die, up to eight or nine feet where the branches all seem to start out like a fountain reaching up to a height of forty feet, forming a perfectly rounded top with a diameter of fifty feet. Yes, this is a true story and my hat's off if you beat it or equal it. The tree is located about three or four miles north of Collegeville, Pa.

Speaking of colored pictures of trees. I never realized how beautifully colored are the leaves of Oaks in early spring, especially of the White Oak. When they first come out they vary from fawn colors to pink and blend in beautifully with the spectacular volumes of the white color of Dogwoods when they happen to be close by.

Coming back once more to the Amelanchiers. Up till last spring the most impressive pictures I have or, I should say remember, are trees I saw grow up rather tall and slender among a grove of Hemlocks, and for many years I looked to see these graceful sprays of white associated with equally graceful sprays of green of the Hemlock. The places where I first saw them is in the Pocono Mountains, the others in our southwestern Counties near or in Indiana County. Some day we shall be required by public opinion to plant bits of Pennsylvania on our public grounds.

There is the case of the American Holly, probably the longest lived tree east of the Redwood trees. At any rate, I saw some stumps of decaying Holly trees, perhaps twenty miles from Cape Charles, that were a full one thousand years old before they ended their career. Then I saw trees in various places I believe to be more than five hundred years old, in perfect condition and bearing each year a full

crop of berries. And again in parts of Jersey, I saw Holly trees more than seventy-five feet tall with trunks straight and of even girth, as though it is not to be classed as a garden shrub, but instead to rank among stately trees of our forests. Of all trees native in America none receives more of the attention and affection for a short period at Xmas, than does the Holly. There is not a home in America that does not have a real sprig of Holly, or an imitation Holly or Holly painted on many and sundry articles at Xmas. Then the fashion or the occasion demands Holly wreaths and Holly branches, and the demand is so great that this annual take-off has definitely decreased the Holly population, and for some reasons few Hollies are ever planted, partly because of a big amount of misinformation that goes around by word of mouth, by stories unfair to the Holly that usually appear before Xmas time. Our American Holly can be planted and successfully raised in most parts of the United States. Some writers say American Holly is inferior to the English Holly. My answer, to that statement, is about three years ago I went to the Morris Arboretum, Chestnut Hill, to try out my new Retina Camera on a fine big American Holly. It was nearly springtime. The Holly tree must have been more than twenty feet in height, branched solid to the ground, its leaves perfect and of an even green, and every branch loaded down with berries. A most brilliant sight when all else was without foliage and the grass a rusty brown. Near by were some English Holly trees that at one time were as tall as the American Holly, but the rigors of our American winters cut down the English Holly to stumps only two feet high, defeated by the same climate so acceptable to the American Holly. There is this difference between the English Holly and the American Holly—and that is, the English Holly does well in any and all parts of our mild American Climate, but it cannot stand our colder parts (I ought to know, I lost many of them trying it out), but the American Holly will do well in all parts where the English can stand it. And more it will live and thrive and grow into a large tree where an English Holly cannot live through real rigorous cold winter.

The American Holly deserves a good reputation. I could talk Holly for a hundred pages. Just outside of my window is a tree nine to ten feet high. It came up from a stray seed off of a Holly wreath one Christmas. Its roots are in an almost impossible place, right at the base of the trunk of a forty foot Larch tree, an excellent place to starve to death, but this volunteer Holly has had berries ever since it was four feet high, and in the summer, of course, we give it water. Some day I am going to cut down the Larch and let the Holly have a better chance to grow. We have Hollies growing from seeds two inches to six inches high and on up to eight feet. When transplanting a Holly remember but one thing. Dig it up

with enough roots and soil that is held by the fibrous roots and after planting, water it. And a year or more after planting feed the tree aplenty, with most any kind of manure and keep watering the tree, and it will grow and bear the berries too.

Now, of course, the berry bearing part of the Holly story is a long one. My claim is no one has the indisputable answer, and we will not have, till some Institution will assign a competent plantsman to the study of the sexual habits of the Holly to once and for all to establish all facts. The practical propagators have a dependable solution now. They propagate berry bearing trees, they do it either by grafting or from cuttings. Both methods are certain to produce for you a tree, that will bear without having another for company. I saw a most beautiful grove of wild Holly trees, just two years ago, sixty or seventy miles southeast of Philadelphia, and they were in full berry in March, a sight I shall always remember. With my guide I tried to find strictly non-berry bearing trees (Male trees). My findings were that in these woods covering many acres there is less than one per cent. of trees without berries.

I wish we could for once welcome to our gardens, our parks, and our campuses native American trees not for sentimental reasons, but for their fine qualities, and for qualities that are not found in exotic trees. Our American trees are distinctly superior, and our institutions of learning should plant native American trees, so the people, the average American, may have a chance to learn to know them. But, as I said before, the average American is finding out about trees through the experience of inspiration, not by college education, no, not at all. Many college bred people still prefer exotic trees to native Americans. Yes, this is no figure of speech, it is a pity, but it is so. Perhaps soon our scientific friends and educational leaders will join one or two of the many pilgrimages to see American trees, just for the love of it or for the fun of it. Yes, most Americans have definitely turned to love and to cherish our own good things, our own native trees, and all this has come about because of the appeal, and the inspiration our people have got from our own trees. But I want to appeal to our leaders engaged in the field of education to join Mr. and Mrs. Average American in recognizing our fine excellent native American trees. No other country can furnish us better trees than our native Hemlock, native White Pine, Sweet Gum, Sour Gum, our great Oaks, our Sweet Bay, our magnificent Amelanchiers, Birches, Hollies, and, can the world beat our eastern and western Dogwoods, *florida* and *nuttallii*? A long list of native trees cannot be made here. I beg of you, approve some of them and maybe in time you will be willing to find some good in any and all native American trees.

ADOLF MÜLLER.

GROUND COVERS FOR SHADY PLACES

THE PROBLEM OF A GROUND COVER is very efficiently and satisfactorily solved for open spaces providing usual soil conditions by the use of various types of grasses. They are beautiful to look at, they prevent or reduce erosion of the soil by wind and weather, and can be kept in order with an ordinary amount of attention.

When the lawn passes into the woodland, the grass cover becomes inadequate largely because of the lack of light. The question of something that can supply the place of grasses then comes to the front. It is advisable that such a cover should be hardy and perennial; it should prevent erosion as effectively as possible; it should be able to live in a more or less reduced light, and if it be an evergreen, it will be the more appreciated for that fact.

In attempting to secure a ground cover for shady places, one may try to obtain such by planting a single species. This seems to be required in cases where formality rules. Among the plants that are used under such conditions we have a rather limited chance in our climate.

English Ivy (*Hedera Helix*) comes to mind as one of the most successful plants for this use. In the first place, it furnishes a genuine ground cover because of its creeping habit and frequent root formation from the stem. It is not likely to take to tree climbing, and it is easily removed when it leaves the ground. Thus, it forms an excellent protection against water erosion, especially on steep slopes. By its close growth it successfully suppresses competition. Moreover, it is evergreen.

Running Myrtle or periwinkle (*Vinca minor*) is an old favorite in half-shade, where it may appear at the edges of woods and along shady roadsides. It again clings closely to the ground, and by its matting habit protects the soil from water erosion and discourages competing plants. The deep, almost bluish-green color of the evergreen leaves, from among which the solitary blue flowers appear, makes a cover of *Vinca* very attractive. It is an Old World plant much grown in gardens and in cemeteries.

Among the more recent introductions is another shade lover from Japan now being much planted. *Pachysandra terminalis*, when young is a stiffly erect dwarf shrub of none too good a green, but interesting partly through its white flowers developed early in the season. It is planted often for its tolerance of shade. It does not cover the soil in the same sense as the plants previously mentioned. Its more

erect habit, with less intimate contact with the earth gives it less control over the washing action of water than they.

Of some horticultural interest as a plant of shady situations is our native Box Huckleberry (*Gaylussacia brachycera*). This rare plant is a low evergreen shrub found in a few places from Pennsylvania to Virginia in the woods, forming close patches of dark green somewhat procumbent growth. It forms extensive beds in the shade in deciduous woods. Its successful growth in deep shade and its rarity gave it greater interest to plant lovers soon after its discovery, and its use commercially was actively developed for a time in spite of the rarity of the plant. Since it has had some legal protection, and now appears to be less rare than was formerly supposed to be the case, interest in this plant as a horticultural object seems to have abated.

For developing a ground cover in shady places, the low sweet Blueberry (*Vaccinium pennsylvanicum*) has many of the good points of the box huckleberry and is more easily obtained. This dwarf blueberry of the higher lands of the Eastern United States, as far south as Virginia, is a low, upright shrub that forms dense patches of light green foliage, with small, bell-shaped early flowers, followed by small, bluish-black berries. The bright green warty stems give a lively color to the bush after the leaves have fallen off. The shrub forms a close bed that sometimes comes to the edge of the woods along roadsides, or creeps out into the more open edges of rock ledges. Its habit of growth and its tendency to monopolize the site make it a good soil protector, as well as an attractive woodland plant. It grows readily, is easily multiplied and can be successfully transplanted. When set in close order in mildly acid soils, it is likely to be a real acquisition in shady woods and on banks.

Another native shrub seems to deserve consideration in this connection. Our only American yew (*Taxus canadensis*), ground hemlock, or to the Indians in Wisconsin, "shin tangle," grows in the acid leaf mold of woods, where its decumbent habit of growth and rather irregular branching give it the distinctive characters suggested by the Indian name. This green plant will be found in the deep woods, from which it breaks out at woodsides or into other well-lighted areas. It forms a rough and irregular cover that sometimes competes with other more erect shrubbery.

It would be inadvisable to omit the Japanese Honeysuckle (*Lonicera japonica*) from the list of plants available for the purpose here under discussion, but when

one sees what a pest it becomes when not subject to strict control, it is a question whether it should not be condemned at the start. This potentially beautiful and fragrant plant will cover the ground with a net of thready stems that root firmly into the soil. It lives in sunshine and in shade, and it climbs trees and chokes the young trunks in its tight grip. When controlled and trained, it will produce its delightful flowers. It is much used in planting roadside banks, where it will be helpful as long as it is kept under control. One shudders at what it may do later after seeing it take possession of fields and woods in the sandy lands of Maryland and elsewhere.

Among the plants forming a dense floor cover in spring is the Japanese anemone (*Anemone nemorosa*, L.). It spreads by slender rhizomes that occupy the woods soil rather closely, and forms light green solid mats that show a wealth of pale rose to white flowers in late April at the Arboretum. They look like large, half-closed nodding wind flowers, perhaps an inch across. Soon after the short, flowering season is over in early May, it dies to the ground. This plant, obviously, is not a good ground cover by itself, although it holds its own and with time spreads gradually among the English Ivy that seems to give ground before it.

The problem of the ground cover thus far has been considered as one related to that of the lawn, in which uniformity of growth brings an air of formality. This note is seen in the use of pure culture plantings with uniformity in the depth of growth produced.

The ground cover may be of quite another type, in which formality is given up for variety by using plants of diverse height, habit of flowering and place in the succession of mixed plantings. This type of cover introduces paths, roads and other features of convenience or of ornament. The plot then thickens, and the almost infinite variety of available plants makes all things possible. Even the perfection of wild nature may be approached.

RODNEY H. TRUE.



THE ANNUAL BUS TRIP

THE SIXTH ANNUAL SPRING BOTANIZING TRIP of the Department of Botany and the Morris Arboretum took place from June 20 to 24, 1939. These expeditions, which were inaugurated in 1934 by Dr. Rodney H. True, have as their objective

the intensive exploration of a section of Pennsylvania not heretofore visited by botanists from the University of Pennsylvania. Although Dr. True was unable to accompany the party this year, he generously provided the use of the Arboretum bus, which has transported the members of all the previous expeditions. As in the past, the personnel was composed of members of the staff and graduate students of the Department of Botany.

The area selected for exploration this year was a tier of six counties (Perry, Juniata, Snyder, Union, Lycoming and Tioga) lying west of the Susquehanna River and extending from just above Harrisburg to the northern boundary of the state. As the two lower counties have received some attention from the botanists at the State Museum in Harrisburg, only one stop was made in each, the bulk of the collecting being done in the four northern ones.

The bus, with ten members in the party, got under way early on Tuesday, June 20, and proceeded without stopping to Harrisburg. The first break in the trip was made a few miles north of Harrisburg, where we stopped to eat lunch and collect along the river shore. Many of the characteristic plants of the Susquehanna drainage were in evidence here and as the party scoured the broad sand and gravel beach most of the species seen were recognized as ones which we had found over and over again in 1938, when the expedition had concentrated its efforts on the flora on the East Fork of the Susquehanna many miles farther north. Here, for example, the sandbar willow (*Salix longifolia*) formed dense low growths covering many square yards. This plant follows both the Susquehanna and the Delaware Rivers all the way from the southern to the northern boundary of the state. Another familiar species abounding here, and in full flower on this date, was the water willow (*Dianthera americana*). This interesting plant is in no way related to the true willows, although it resembles some of them in the shape of its leaves, but belongs rather to the Acanthus family. The water willow likewise fringes the shores of the Susquehanna but, strangely enough, is almost entirely absent from the Delaware River drainage.

After making a representative collection of the plants occurring at this locality, the party continued northward to a point a few miles above Liverpool, in Perry County, where two still different types of habitats were explored: rich, wooded cliffs on one side of the road and an abandoned desiccated canal bed on the other. Here the party was divided into two units in order to save time. One group ascended the steep slope and returned to the bus an hour later with a fine variety of rich woodland and rock-inhabiting forms. The other group followed the grassy

canal bottom which supported an amazingly varied flora of interesting grasses and sedges. The outstanding discovery at this locality was a species of sedge (*Carex caroliniana*) hitherto known in Pennsylvania only from the extreme southeastern counties.

The next stop was along the West Branch of the Mahantango Creek, which separates Juniata and Snyder Counties. Here again teams were organized and assigned to opposite banks of the creek with the idea of tapping all available habitats. The flora was characteristically that of rich river bottoms, the real surprise being provided by the finding of golden club (*Orontium aquaticum*). This plant, which is dominant in wet habitats on the Coastal Plain, enjoys but a scattered distribution inland and its discovery in Pennsylvania is always a matter for rejoicing.

By this time we had collected over three hundred numbers (and those on a day designed primarily for covering ground) and it was imperative that we push on to our destination. Arrangements for the night had been made for us by Mr. and Mrs. Douglas E. Wade of Beavertown in Snyder County. Mr. Wade is a member of the Pennsylvania Game Commission and during the time that he has been stationed at Beavertown, has been doing a fine job of collecting plants in all corners of the county and sending his specimens to the University Herbarium. He and Mrs. Wade, herself no mean botanist, had agreed to act as our guides the following day.

The Wades called for us at our cabins west of Beavertown on Wednesday morning and took us first to some interesting woods near McClure at the southwestern corner of the county. The hour or so devoted to sampling this region yielded a varied series, one of the noteworthy features of which was a fine stand of cancer root (*Conopholis americana*). The next stop was along Middle Creek, three miles east of Beavertown. Two parties were detailed to explore the woods along the creek, a third essayed the ascent of a wooded calcareous ridge which parallels the creek for several miles. This last-named habitat furnished considerable excitement for those who never before had botanized on limestone crests and ledges, for here were many of the members of that limited but interesting assemblage of calciphiles usually found associated in such situations. One of the characteristic trees, for example, was the yellow oak or chinquapin oak (*Quercus Muhlenbergii*), seldom found off limestone. Here, too, was the fragrant sumac (*Rhus aromatica*) so often occurring with the oak, and differing from its unpopular relative, poison ivy, in its hairy under leaves and velvety red berries. On the bare rock ledges was purple cliff brake (*Pellaea atropurpurea*) and on the wooded crests flourished fine

stands of hoary puccoon (*Lithospermum canescens*) and Seneca snakeroot (*Polygala senega*).

After lunch another section of Middle Creek, lying near Paxtonville, was made the center of activities. A rich swale yielded a diversified series of grasses and sedges, among them the rather uncommon *Carex Frankii*. A combing of the alluvial thickets along the stream brought to light a still different lot of species, including a second station for *Orontium aquaticum*. But the real prize of the occasion was the discovery by one group of a colony of the rare green dragon (*Arisaema Dracontium*), with some of the plants fully three feet high. The bus then headed north to Penns Creek, where a large tract of open rocky woodland was scrutinized. Here it was each man for himself, as individual members of the party radiated out from the bus to return upon a signal from the driver. In cases like this we made it a practice on reassembling carefully to compare our finds before putting them in press, in order to avoid duplication.

The Wades had several other places to show us, but the day was already far advanced and our field presses were filled to overflowing, so we were forced to return to our cabins where it took us until midnight to put out material into driers.

The following morning, Thursday, June 22, the Wades guided us in their car over a network of country roads to the top of the ridge which separates Snyder from Union County. Here we parted, they to return to Beavertown, we to push northward to the conquest of Union County. Compared to Snyder County, with its rich variety of habitats and miles of wild country, Union seemed a pretty tame affair. It is highly agriculturalized and rather uniform as to soil types. We spent the entire morning in the routine task of raking the sterile woods near Laurelton. Our prime objective on these trips is to collect each species at least once in every county visited. So we now set about collecting everything in sight, even though many of them had already been taken in the counties just traversed. This is termed "putting the plant on the map" for a given county, and it is literally that, for these collections are later used as the basis for dotting in on outline maps of the state the known distribution of each of the approximately 3000 species of higher plants which occur in Pennsylvania, and the ultimate goal of this work is to have a record of each species from each county in which it grows.

After looking in vain in western and central Union County for interesting native habitats, the party turned eastward and headed for the river shore, feeling that here there might be greater variety. At the first point, New Columbia, many of the characteristic shore forms were found, including an unusual species of arrow-

head *Sagittaria heterophylla*. A few miles further up the river we paused to sample the wooded slopes of White Deer Ridge, and received our first real element of Canadian types. The best find, however, was the Alleghenian table-mountain pine (*Pinus pungens*). Although this is a somewhat common tree in the south-central counties, it has only once before been collected as far north as Union County.

Thursday night was spent near Montoursville, where the party had stopped on the 1938 trip, and the following day, June 23, was devoted almost wholly to Lycoming County. After a careful study of the topographic sheets of this area, Hall Pond had been selected as a locality which promised type of boggy-pond shore often productive of the greatest botanical excitement. In reality Hall Pond proved to be not a pond but a vast area of *Rhododendron* swamp, so extensive and so interesting that it engaged our attention for the entire morning. Here were many species of a northerly distribution such as *Oxalis montana*, *Tiarella cordifolia*, *Circaea alpina* and *Coptis groenlandica* along with a host of characteristic bog plants.

Two other stops were made in Lycoming County that afternoon and each yielded many good things. Late in the day we entered Tioga County and, as an opening wedge, stopped briefly along Wilson Creek, 3 miles north of Morris. The choice was a happy one, for a short half-hour of frenzied collecting revealed a rich flora, including among many other things, the acute-leaved hepatica (*Hepatica acutiloba*), red baneberry (*Actaea rubra*), twisted stalk (*Streptopus roseus*) northern waterleaf (*Hydrophyllum canadense*) and two rather uncommon grasses, *Milium effusum* and *Glyceria grandis*.

Nightfall found the expedition in cabins at the Leonard Harrison State Forest Park on the brink of Pennsylvania's "Grand Canyon." This spot had been chosen so that we might participate in a scheduled field trip of the Torrey Botanical Club held on June 24-25. About 40 members of the Torrey Club were in attendance and on Saturday morning, the 24th, our party joined them and, under the leadership of Dr. Frank D. Kern, of Penn State College, explored the rocky woods on the brink of the canyon. Here in addition to many of the plants we had collected for the county the preceding day, were countless novelties, among them being red pine (*Pinus resinosa*) and paper birch (*Betula papyrifera*).

The region is one of great scenic beauty as well as botanical interest and the temptation to spend an additional day here in such delightful company was indeed strong, but our presses were more than full, every one of the many hundreds of driers and ventilators we had brought along was already doing double duty, and for us to have lingered longer and collected more would have been to court disaster,

so far as much of our material was concerned. So early Saturday afternoon we headed for home, after four and a half days of actual field work. Despite this curtailed period, however, the total collections made fall just short of two thousand numbers, by far the largest bulk of material ever amassed on one of these excursions. The University Herbarium is enriched by specimens from a group of counties not previously well represented in its collections and the sum total of our knowledge concerning the distribution of the plants of Pennsylvania has been appreciably increased.

J. M. F., JR.



WINTER LECTURES

December 9, 1939

MR. CHARLES F. JENKINS

Hemlocks

Long connected with the publication of the nationally known agricultural periodical "Farm Journal." Widely interested in affairs for public advancement. A great lover and student of Hemlocks.

January 13, 1940

MR. ADOLPH MÜLLER

Native Dogwoods

President of the Dogwood Association, and leader in popularizing our native dogwoods. Formerly State Game Warden of Pennsylvania.

February 10, 1940

MR. REGINALD D. FORBES

*Federal Forest Research
in Pennsylvania*

Director of the Allegheny Forest Experiment Station, a Federal agency working in co-operation with the University of Pennsylvania.

March 9, 1940

MR. SAMUEL N. BAXTER

Trees for Street Planting

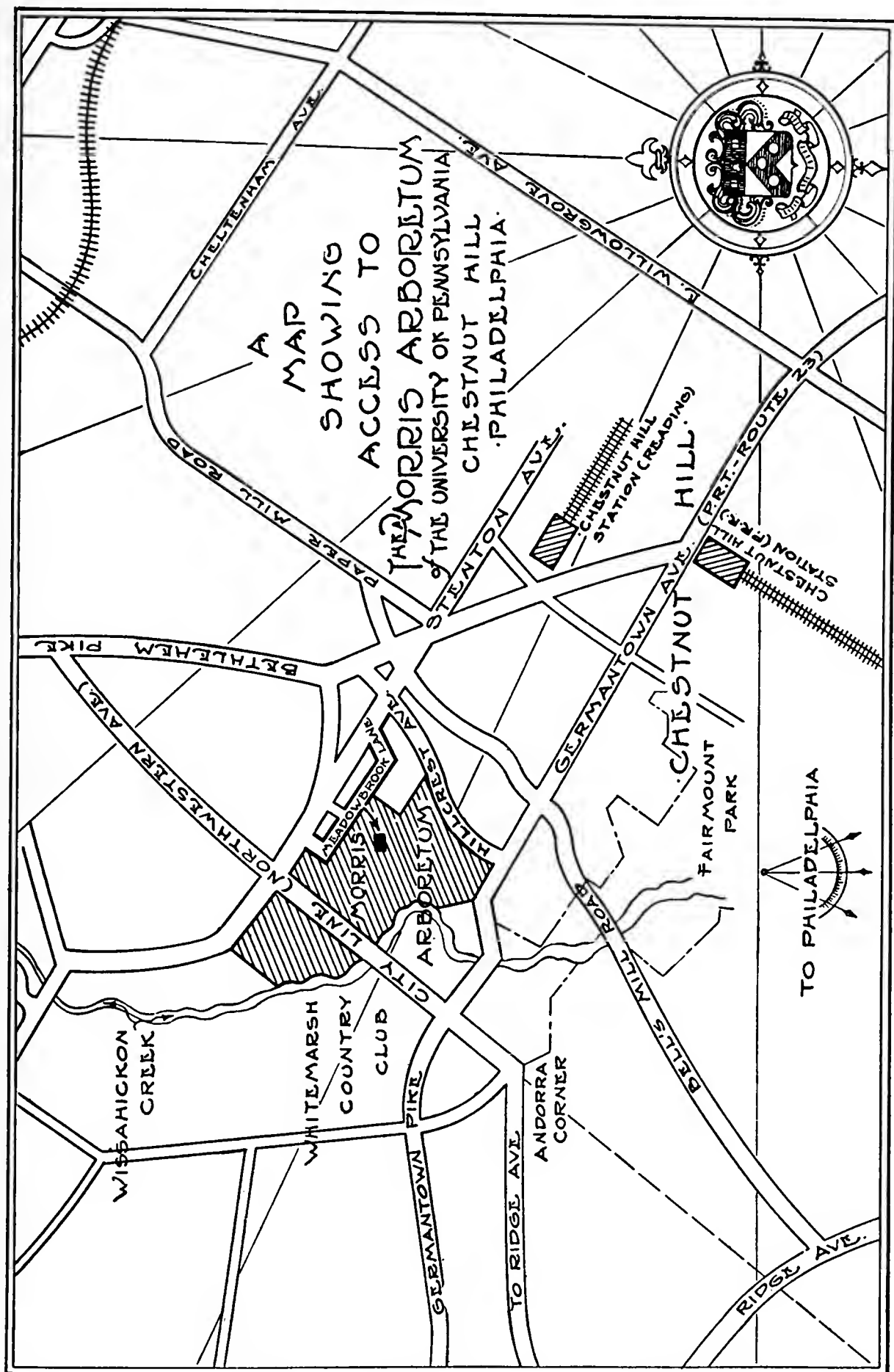
Arboriculturist and Landscape Gardener of the Fairmount Park Commission.

April 13, 1940

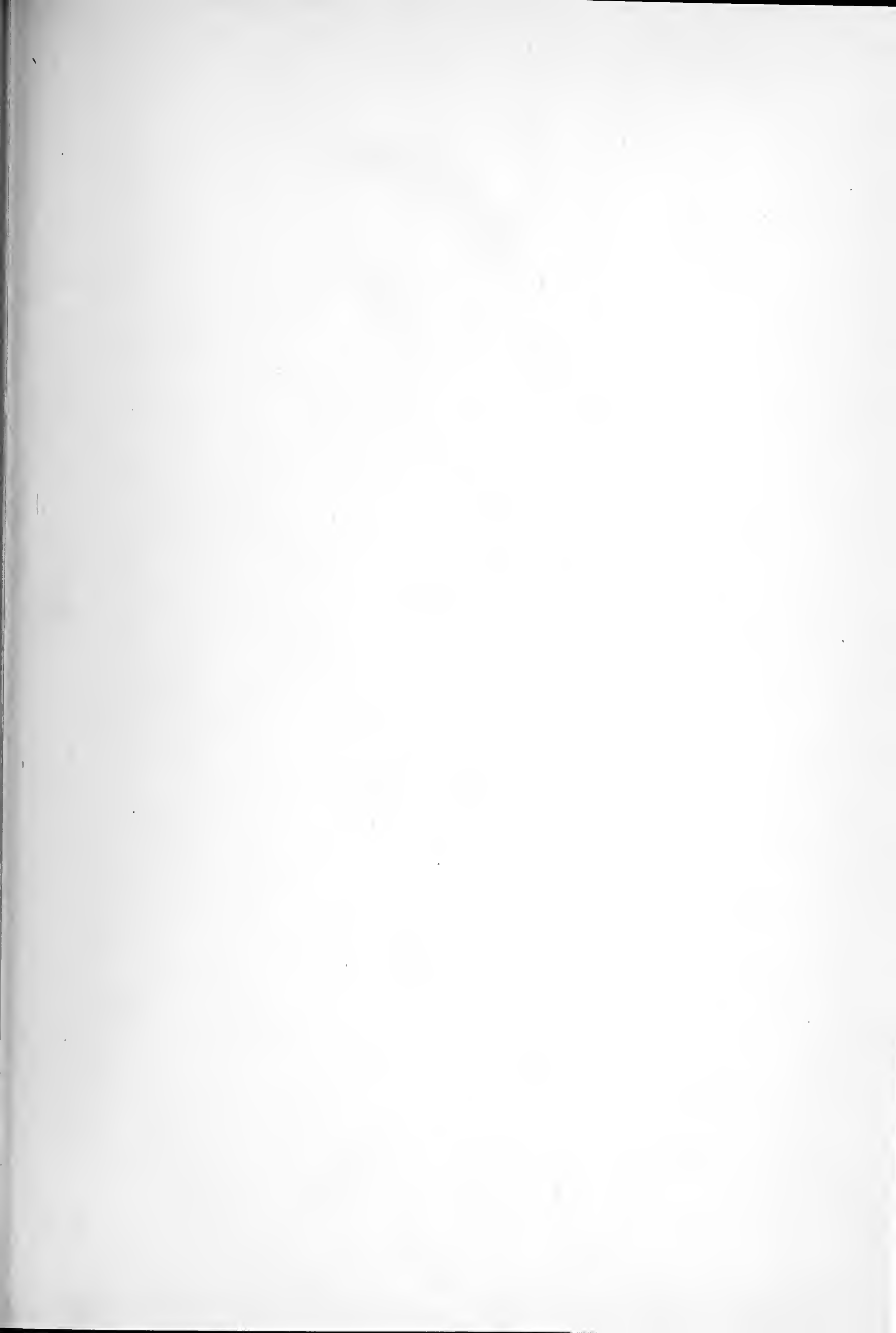
DR. JACOB R. SCHRAMM

The Black Locust

Director of the Department of Botany and of the Botanical Garden of the University of Pennsylvania; succeeding Director of the Morris Arboretum.





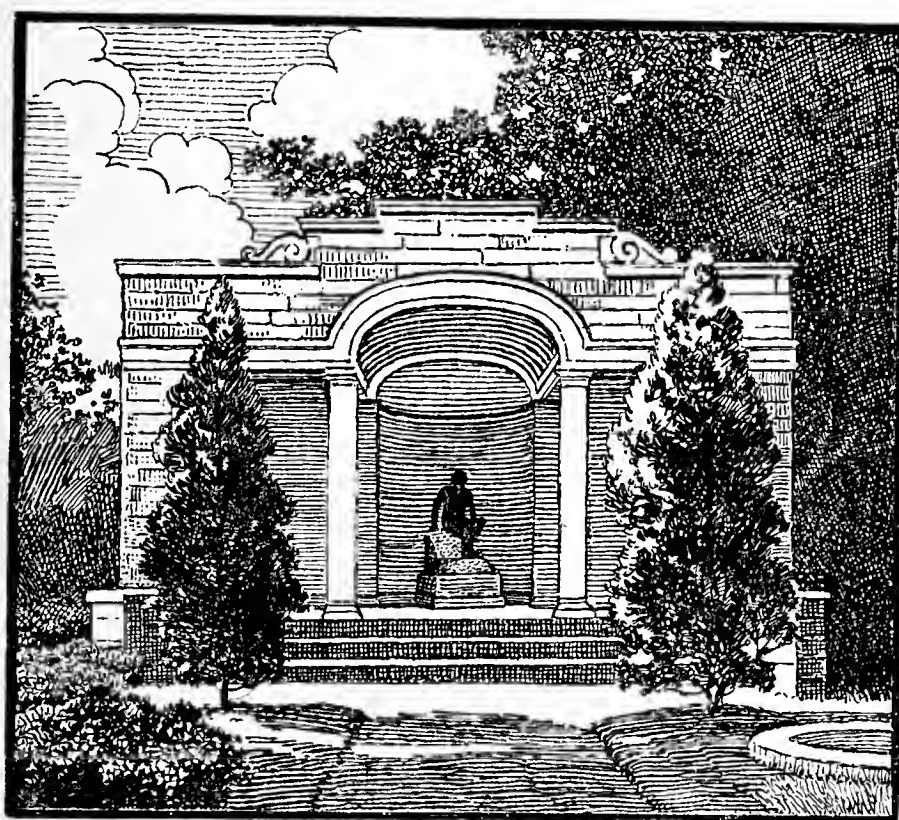






ARBORETUM BULLETIN
OF THE
ASSOCIATES

JANUARY, 1941



THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

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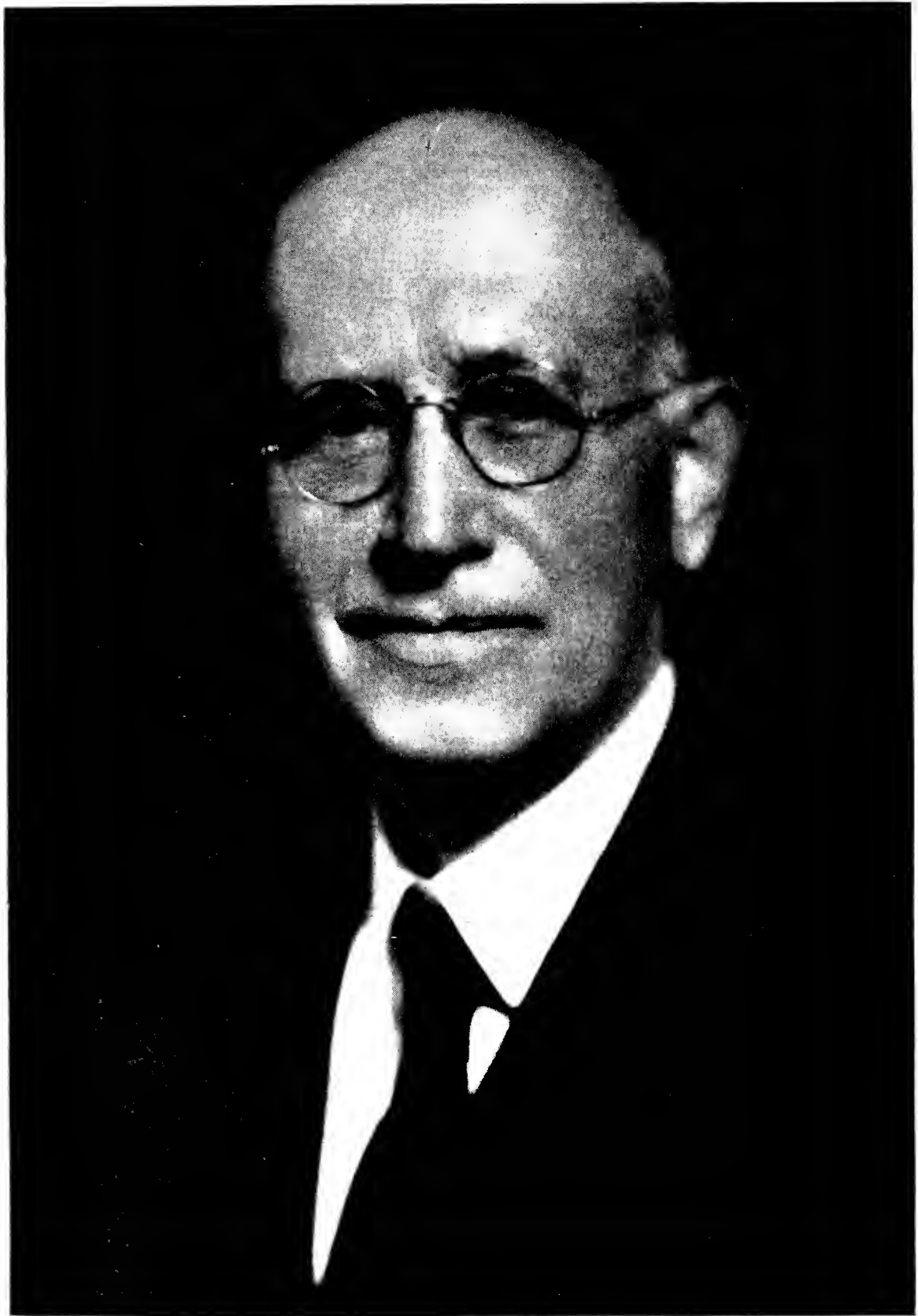
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THE
MORRIS ARBORETUM
OF THE
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Pyramidal Norway Spruce
Picea Abies pyramidata (Carr) Rehd.

ARBORETUM BULLETIN — VOL. 3, NO. 18, JANUARY, 1941



DR. RODNEY HOWARD TRUE
1866 - 1940

In Memoriam

DR. RODNEY HOWARD TRUE—1866-1940

ON APRIL 8, 1940, Dr. Rodney H. True, first and late Director of the Morris Arboretum, died at the age of 73. In failing health for some months, he retired from the directorship on November 1, 1939, though continuing to live at his Arboretum home until his death.

Dr. True's scientific achievements—and they are many and distinguished—are a matter of record. Moreover, summaries of these have already appeared in the scientific press and others are to follow. Therefore, it is perhaps more appropriate and fitting here to dwell upon those qualities and attributes which motivated his life and which gave direction and strong purpose to his fruitful activities—of which the scientific was only one of many.

If we were to attempt to epitomize in a word the essential qualities of Dr. True's character, we probably would agree that they sum up to a striking unworldliness. Uninterested in his personal material fortune, generous to a fault (little do we know of his generosity because bestowed so quietly and unobtrusively), indifferent to considerations of position and fame, social and otherwise, Dr. True had his life and being in the intellectual, artistic, and spiritual realms. They pervaded his every interest and effort. At heart an artist and a poet, he had a passionate love for and discriminating appreciation of art, music, and literature, especially poetry. He was a stout defender of what he considered to be right, irrespective of the possible consequences to himself. What he perceived as injustices, social or otherwise, stirred him deeply.

And throughout there ran an interest in and a devotion to matters of the intellect that persisted tenaciously to the very end. Mine was the rare privilege of witnessing this, realizing that under far less trying conditions most of us would have found our intellectual powers dulled and rendered impotent under the impact of physical suffering. In him mind was indeed master of the body.

One of Dr. True's many interests was history, and especially history of agriculture. In late years this interest turned to Thomas Jefferson, partly through a fortunate circumstance, though I suspect that the character of Jefferson was itself a lodestone to one constituted as was Dr. True.

The Jefferson Garden Book came to light in the library of the Massachusetts Historical Society. In Jefferson's own handwriting throughout, it reflects the amazingly diverse and deep methodical interest in horticulture and agriculture on the part of this intellectual giant. This book Dr. True deciphered where necessary, completing the final correction of the transcription only a short while before his death.

But this was only a beginning. Starting from the prosaic, day-by-day entries in the Garden Book, Dr. True, through discerning and discriminating historical research, connected some of these, notably those on rice and grapes, with deep social and humanitarian concerns, thus illuminating an important new facet of the apparently endless interests of Jefferson. Fortunately, thanks to Dr. True's intellectual tenacity, the essentials of several of the most significant of these findings were got on paper during the closing weeks of his life. These cannot be anticipated here, but it is hoped that their publication will not be long delayed.

It is not too much to say, for it reflects the judgment of competent historians, that Dr. True's was indeed a genuinely historical sense. His career might equally well have been, and indeed was in part, that of a discerning historian, who not merely records but interprets against a comprehensive background.

It is a matter of deep regret that Dr. True's profound knowledge of the history of agriculture could not have been preserved for posterity in book form. Responsibilities and preoccupations in other directions prevented this. There are excellent specialists in various aspects of the history of agriculture. But I doubt that there is anyone in America whose knowledge is so comprehensive from ancient times to the present. Dr. True knew the history of agriculture from the point of view of the art and the technique. But more than this, he knew it in its contemporary economic, social, and political settings, giving him an integrated grasp of the subject rarely achieved.

Dr. True's was indeed a many-sided and intensely intellectual life. His brilliant mind, his prodigious knowledge, his devotion and service to the Arboretum, and, above all, his friendly presence, will long be missed.

J. R. S.

SPRUCES

ANY PRETENSE at a planting of evergreens, however simple or elaborate, might very appropriately include specimens of Spruce, whether they be grown as isolated plants, or as forming part of a group of plants. The clean-cut triangular outline and pyramidal form of a single specimen may exhibit perfection of symmetry unsurpassed by other evergreens. Variations in color of foliage from dark green to bluish green, from golden yellow to yellow green in varietal forms, make them objects of contrast and delight the year round, and especially so when other vegetation seems lifeless and brown. Through their slow but sure development they build up ornamental characters which may abide for many years. Their habit and foliage characters are enhanced by the appearance of red or yellow staminate (male) cones and green, brown, or purple ovulate (female) cones at certain seasons of the year.

Although spruces possess definite foliage and cone characters which distinguish them from Firs, the two groups are often confused and still treated by some as one. The genus *Picea*, the Spruce, is readily distinguished from the genus *Abies*, the Fir, by the short stalk (sterigma) which supports the leaf. When the leaf drops, the stalk persists as a woody peg-like projection which gives the twig a rough surface. The leaf of *Abies* disarticulates flush with the twig surface, leaving a round scar and a comparatively smooth twig surface. This is a simple means of separating Spruces from Firs when dealing with leafless twigs or branches, but leafy twigs lend themselves also to simple means of identification. Whether the twig surface will become smooth or rough with the shedding of the leaves, can be determined by locating the position of the leaf-articulation or joint at which defoliation occurs. In detached twigs of Spruce, the leaves drop with the drying out of the twig. The *form* of the leaves, although not conclusive evidence in all cases, is a further aid in separating Spruces from Firs. In the former they are decidedly angled in cross section while in the latter they are mostly flat and relatively broad. Flat-leaved forms of *Picea* are sometimes confused with the genus *Tsuga*, the Hemlock, but the Hemlock leaf is narrowed abruptly at the base into a short definite stalk (petiole) in contrast to the Spruce.

As to cone characters, the female cones of *Picea* are usually pendulous from the branches and do not fall apart when mature, being shed as complete cones. In *Abies* the cones are usually upright on the topmost branches and shatter when reaching maturity.

Picea includes about forty species widely distributed throughout the northern hemisphere from the Arctic Circle to high mountains of warm-temperate regions, some species forming great forests. Seven of these species are native to North America, some of which deserve special mention as important forest trees. *Picea mariana*, the Black Spruce, reaches its maximum development in the boreal region of North America where it covers large areas and attains its largest size. *Picea rubens*, the Red Spruce, often forms a large part of extensive forests in eastern North America and extends southward on the slopes of the Allegheny Mountains to Tennessee. *Picea glauca*, the White Spruce, ranges from Labrador to Alaska and south to Montana, Minnesota, and New York. One form, *Picea glauca* var. *albertiana* Sarg., is common in valleys of the Black Hills of South Dakota and the Rocky Mountains of northern Wyoming, Montana, and northward. *Picea Engelmannii*, the Engelmann Spruce, is distinctly a western species, often forming great forests from Alberta, Alaska, and British Columbia southward to New Mexico and Arizona. It attains its best development in the region north of the United States. Other western species are *pungens*, the Blue Spruce, and *sitchensis*, the Sitka Spruce.

Exclusive of its Nursery, the Morris Arboretum contains a collection of more than forty specimens of Spruce, representing at least twelve species, some with a number of varietal forms. This affords more than usual opportunities to visitors and students who wish to observe and study a fair representation of Spruces in a single collection. Attention may be drawn to some of them.

Picea pungens, the Colorado Blue Spruce, with its variously colored foliage of silvery white, bluish white, golden yellow, bluish green, blue, and green, might be regarded as one of the popular species grown for medium-sized plants. Its form alone makes it an outstanding figure in any landscape. The variety *Kosteriana* (*P. pungens glauca pendula* Beiss.), the Weeping Blue Spruce, with its bluish-white foliage and pendulous branches always attracts attention, except when good symmetry is desired. A specimen may be seen halfway between the Swan Pond and the Lodge. A handsome specimen of variety *argentea*, with its silvery-white foliage, is located near the Main Gate. A larger specimen is near the lower drive. The variety *argentea*, synonymous with *Kosteri* or *Kosteriana* of the trade, preserves its pyramidal form with increasing age better than most other varieties, but all forms of *P. pungens* unfortunately tend, as they grow older, to shed their lower branches.

Picea polita, the Tigertail Spruce, is quite distinct from other Spruce species in its rigid, spiny-pointed, dark-green lustrous leaves, which are spreading and

radially arranged, sometimes curved. The dark-brown winter buds are very conspicuous, with their scales persisting for a long time as a blackish sheath, thus setting off successive seasonal growths very sharply. Color variation of the branches is very noticeable from the last growth traced backward four to five years. A grasp of a twig is quite convincing of the rigid spiny character of the leaves. This species should make a good hedge plant. Several specimens are located in different parts of the Arboretum: by the Nursery, the Cloverleaf Fountain in the southwest corner of the Arboretum, and a fine specimen near the Lodge. Of the rarer species, this is one of the most popular for decorative garden work. *Picea polita* is an introduction from Japan.

Picea orientalis, the Oriental Spruce, from the Caucasus, may be recognized by its short (less than one-half inch long) dark-green crowded leaves. It is valued as an ornamental for its shining leaves and graceful habit. Several varieties are in cultivation. North of the main entrance drive is a specimen with drooping lower branches which are attached to the main stem six to eight feet from the ground, but with their extremities touching the ground. The lower branches may persist for many years. Another tree is located on the hillside south of the Mansion.

Picea Abies, the Norway Spruce, is native to Europe. It was introduced into this country many years ago and is now grown extensively as an ornamental, being regarded as one of the most popular species. Close to fifty garden forms have been named on the basis of color variation, columnar or pyramidal habit, pendulous branches, and low-growing dense types. From ten to twelve forms are distributed throughout the Arboretum. Var. *pyramidata*, by the Cloverleaf Fountain, is a good example of pyramidal form. (See Frontispiece.) The lower branches are long, close to the ground, and densely clothed with branchlets and leaves. Var. *Maxwellii*, in the Japanese Garden, is an unusually dense, low form with numerous short impenetrable branchlets bearing finely pointed leaves. To ascertain the age of the plant would be puzzling. Nearby is another dwarf form, var. *pumila*.

Picea omorika, the Serbian Spruce, is a hardy species with compressed leaves which closely resemble those of the Fir. Each leaf has two white bands on the upper side. A handsome tree is located in the Cloverleaf Fountain group of evergreens.

Picea Engelmanni, the Engelmann Spruce, a very desirable ornamental tree, is represented by two small specimens: one north of the Mansion and the other near the Lodge Gate.

Four small trees of *Picea asperata* are located on the west side of the Nursery and a medium-sized tree at the corner of the Rose Garden. *P. asperata* is an introduction from China, where it becomes tall and valuable as a timber tree.

Picea Maximowiczii, the Japanese Bush Spruce, distinguished by its short, spreading leaves and resinous buds, has little value as an ornamental and is not very common in cultivation.

This short treatment of Spruces does not give a comprehensive picture of all the specimens in the Arboretum, as less than half have been considered. In a collection of evergreens where different genera and species are in miscellaneous groups, individuals are often overlooked. The citations above aim to point out more or less definite locations of a small number of them, to emphasize characteristics by which some may be recognized, and to give some idea of the wide geographical sources represented in the collection.

If the Nursery collection were included, additional species and forms would double the number.

Irwin Boeshore,

*Department of Botany,
University of Pennsylvania.*

FEDERAL FOREST RESEARCH IN PENNSYLVANIA

THE OBJECT of the investigations carried on in Pennsylvania and the adjacent States by the Allegheny Forest Experiment Station* is the same as that of foresters' activities everywhere—to make our forests fully useful to Man.

Pennsylvania once led all the States in the production of lumber. No finer white pine ever grew anywhere than in parts of the Allegheny mountains, and our hardwoods have been shipped to every State in the Union. Only recently white oak from Chester County was used in the great bridge across the Golden Gate at San Francisco. The State still produces a little lumber, and very considerable quantities of other wood products: cross ties, piling, mine timbers, pulpwood, veneer, and so-called chemical wood.

A few years ago the Allegheny Station made some rough calculations of the amount of wood its territory—Delaware, Maryland, and New Jersey, in addition

* Maintained by the United States Department of Agriculture at Philadelphia, in cooperation with the University of Pennsylvania.

to Pennsylvania—might produce if our more than 20,000,000 acres of forest land were managed as intensively as the forests of the Old World. Assuming no increase in wood consumption by these wealthy, highly-industrialized States, we estimated that we could produce the greater part of the softwoods we need, and a considerable surplus of hardwoods. I personally look forward to the day when the United States will list wood in many forms among its major exports. But not until we have put our forest house in order!

Pennsylvania's forests do vastly more for Man, however, than supply us with wood. Although foresters are, unfortunately, not yet able to express in concrete terms the beneficial influence which a good forest exerts on the flow of streams, we are confident that there is no better watershed cover than such a forest. Prevention of erosion, and equalization of streamflow throughout the year, are of enormous importance in a territory which includes such rivers as the Delaware, Susquehanna, and Allegheny. Our 16,000,000 people use these streams intensively for water supply, navigation, generation of power, recreation, and commercial fisheries; we are cursed by their destructive power in floods, which in 1936 caused us about \$200,000,000 worth of damage.

But perhaps the greatest service our forests render to Man is spiritual. Recreation in the broadest sense is to be had for the asking in Penn's Woods. Hunting, fishing, camping, picnicking, tramping, and sheer enjoyment of natural beauty, add immeasurably to our health and sanity in these nerve-wracking days. "With arms outstretched the Druid wood waits with its benedicite," and in ever-increasing numbers Americans today seek this benedicite.

If the aim of the forester is to make the forest fully serve mankind, it is clear that our forest research should deal with both biology and economics. Because the average person is probably more interested in biology than economics, I shall describe the Station's economic researches only by title, as it were. For the last 2½ years, in close collaboration with other bureaus of the U. S. Department of Agriculture, and the Army Engineers, we have been making flood control surveys. These appraise the damages done by floods in this territory, and recommend such improvements in watershed vegetation, both agricultural and natural, as we believe will at least pay for themselves. Just last year we received an appropriation for a survey of forest employment opportunities in the anthracite coal region of Pennsylvania. This survey should reveal how much emergency labor is needed to rebuild the greatly depleted forests of the coal region, and how many jobs might be created by permanent forest industries based on the restored resource.

The Station's biological researches necessarily deal with forests rather than with trees. The forester's concern is the *natural vegetation* growing on thousands and millions of acres. Unlike the farmer, who this year has alfalfa growing in a certain field, next year corn, and a third year wheat, the forester can control only to a limited extent the kinds of trees growing on these huge acreages. Even in Pennsylvania, where many forests have been established by artificial planting, an overwhelming percentage of forest land is covered by the tree species which Nature, not Man, selected for the purpose. If Man finds some of these species less useful than others, he can theoretically use his axe and saw more heavily against them than against the more useful species. Practically, however, he does just the opposite. The lumberman cuts the useful species, which are the only ones he can sell, and leaves the others in possession of the ground.

Some of the earliest and most fundamental research of the Station has been directed toward finding out what tree species Nature favors under our conditions of soil and climate, and why she favors them. In other words, in all reverence I may say that we are trying to find out "which way the Almighty is going, in order that we may get things out of His way." We have made intensive studies of the tiny remnants of our virgin forests—now amounting to less than 1/10 of 1 per cent of the total forested area—in order to determine the requirements for growth of the different tree species, and their behavior in relation to each other. This information we will apply to the second- and third-growth forests, in order that in our efforts to increase the proportion of useful species we may work *with* natural forces, instead of against them. It would be inexcusable arrogance to do otherwise.

The virgin forests we have studied are on the Allegheny Plateau of northwestern Pennsylvania. Here grew the white pine which was the glory of the Pennsylvania lumber industry, following the Civil War. We feel that we have abundantly proved, as others before us have suspected, that on the comparatively heavy (unglaciated) soils of this region white pine maintained its place among the hemlocks, beech, sugar maple, and yellow birch only as a result of catastrophes. These catastrophes were apparently very heavy local winds, amounting sometimes to hurricanes, and forest fires, set by lightning or Indians. Evidence of windfall, consisting of humps and adjacent hollows where large quantities of soil clung to the massive roots of felled trees and were gradually washed off, we have found to endure for well over a century. Charcoal in the soil is an even more enduring proof of past fires. The areas visited by such catastrophes were generally small, but sometimes ran up to a few hundred acres. The nearly total absence of shade, and

the exposure of mineral soil wherever the "duff," or surface mat of fallen leaves and débris, was burned away, evidently favored white pine seedlings and discouraged the hemlock and hardwood seedlings. White pine seed is light and winged, and seed-bearing trees were vastly more common in the virgin forest than in our present-day forest. The stricken areas, therefore, often came up naturally to a dense growth of white pine.

As the white pine is a rapid grower, and in crowded stands casts heavy shade, almost pure forests of this species dotted the primeval landscape. Our research shows that these exist for only one generation, however. At perhaps 200 years they begin to thin out, and beneath them comes up an understory of shade-enduring species, the hemlocks and certain hardwoods. Gradually the pines mature and die. Although they seed abundantly, none of their progeny can stand the conditions immediately beneath them. With just one exception, where high winds struck twice in one spot at an interval of about 125 years, no natural white pine stand of which we know has been followed by another pine stand. The inference is to us plain. If we want white pine in our future Allegheny Plateau forests, we must simulate the soil and shade conditions which favored its ancestors. We must create sizeable openings when mature timber is cut, and perhaps we should burn the logging débris, under proper safeguards. We must of course be assured of an abundant pine seedfall, or plant the area artificially. Similarly, in recently-logged areas where white pine seedlings have managed to get a start we must give them some help against the hardwoods.

Another rather fundamental investigation has given us a reasonable explanation of the absence of second-growth forests from certain locations in the Allegheny Plateau. These are depressions along shallow stream courses, which stumps of the virgin timber show to have been forested once, but which have remained bare following logging, although the surrounding territory has long since reforested naturally. Maximum and minimum thermometers read for several years in one such location in our Kane Experimental Forest, Elk County, Pennsylvania, show that this is a frost pocket, and that in the spring months when newly-germinated tree seedlings are frost-tender, the nights are 6° or 8° F. colder than at an adjacent station having better air drainage. Moreover—and this phenomenon we have never explained to our satisfaction—the day temperatures are correspondingly higher. In short, in such situations the tiny trees must withstand a daily temperature range greater by 12° to 15° than in surrounding lands. It will take a long time before these frost pockets reforest naturally. Obviously, they

should never have been heavily logged, for other climatic studies we have made show that a forest cover ameliorates extremes of temperature.

Perhaps the greater part of our biological studies deal with the practical, every-day problems of the forester. Among these is timber stand improvement, familiarly known as TSI to many of the CCC boys. The object of TSI work is to improve the growing conditions for the relatively small number of trees in a young forest that will have room to mature. Nature, particularly in our beech-birch-maple forests, is prodigal of life. Out of 10,000 seedlings and sprouts that may be growing on an acre of 10-year-old woods, less than 200 can survive to sawlog size. The rest will die in the next 75 years. Unless the forester salvages them, they will fall to the ground, and rot. How many should be cut today for the benefit of a selected few, and how often it will pay to weed or thin the stand as it grows, we have endeavored to find out in sample areas. A small sample will not do, because in a forest composed of eight or ten species the variety of mixtures is enormous. Methods to be followed in a stand largely of sugar maple will not do in one dominated by black cherry and ash. We have today in our Kane Experimental Forest some thirty acres of young stands, experimentally weeded or thinned.

Space forbids telling of a number of other lines of biological investigation we have under way in Pennsylvania. It can only be said that in studying our trees we have not overlooked such enemies of the forest as fires, disease, and destructive insects. We have been particularly interested in the effect of wildlife—birds and animals—on the forest, and of varying forest conditions on wildlife. After all, the forest is a complex of living things. If, in order to survive, we have arrogated to ourselves the right to make the forest serve us, we must never forget that our powers are limited. In order to have power, we must have understanding. I hope that all lovers of trees and forest will sympathize with, and will support, our efforts at understanding Penn's Woods.

R. D. Forbes,
Allegheny Forest Experiment Station.

THE PRUNING OF TREES

THE IMPORTANCE of pruning shade and ornamental trees has been recognized since the beginnings of arboriculture many centuries ago. The views relative to the various phases of pruning, even including its advisability, are of wide diver-

sity. Hence, many tree owners and individuals who are concerned with the care of trees may be in doubt sometimes as to when and how a given species of tree should be pruned.

Trees are the most conspicuous of all plants. They are commonplace things. Yet a beautiful tree, or a group of them, appeals to the best in the souls of most men. Biologically, our understanding of them is scanty as contrasted with that of the majority of our economic plants. The lack of understanding of the life habits



FIG. 1



FIG. 2

Fig. 1. Showing, on left of trunk, the stub of a branch of a Norway maple tree, which was pruned off about 1932. Note break on underside of the stub due to improper pruning methods.—Fig. 2. Unsightly pruning stubs on a hard pine, *Pinus* sp. The workman does not understand how to prune.

of trees and their enemies explains, to a very large degree, the differences of opinion relative to pruning and other phases of arboriculture. The pruning of trees is often looked upon as plain ordinary manual labor. Thus, as a rule, it becomes the work of individuals who have no scientific background and to whom a tree is just so much wood. Figures 1, 2 and 3 illustrate the kind of pruning that is so often done by men who, though conscientious, do not understand the nature of a tree, its scientific and aesthetic value. This kind of work results in more harm than good. Pruning cuts of this type, especially in our broad-leaved trees, become favored places for the entrance of wood-destroying fungi and insects, which in time greatly disfigure and ultimately cut short the life of the tree. The



FIG. 3



FIG. 4

Fig. 3. A branch-removal wound made by a workman who does not understand pruning.—Fig. 4. An ugly canker on a hackberry tree which had its origin from an untreated and neglected pruning wound.

pruning of trees is not merely a matter of sawing wood, but should be considered an art based upon the results of scientific research on the physiology, habits of growth, the relation to the biology, and other factors of the tree's environment.

The question may often be asked: Why should shade and ornamental trees be pruned since natural pruning takes place in the forest? We have all seen the boles or trunks of trees without the slightest trace of a branch for a distance of twenty-five feet or more above ground. An examination of the center of the bole of one of these trees will reveal the traces of branches which were pruned off early in the life of the tree. Owing to the shade from competing trees, the leaves on these branches could not function in the manufacture of carbohydrates, which are so essential to the well-being of the trees. Consequently, the branches died, shortly decayed, and dropped off, and their broken ends were soon callused over.

Shade and ornamental trees grow more or less out in the open. Consequently, the leaves on their branches, except in the inner region of the crown, do not become shaded out so early nor so readily as in the forest. Thus, the branches attain a much greater diameter than in the case of the forest tree before their leaves cease to function. The greater the diameter of the dead branch, the less readily it

will decay and fall off. When this happens, an ugly stub may remain on the tree. The part of the tree which supports this stub grows out over it, but complete callusing may require many years, depending upon the size of this remnant of the branch and the rate of growth of the tree. Meanwhile, the dead wood has decayed, often leaving a hole which may become only partially filled with the occluding callus. The collection of water in such openings is highly favorable to the entrance and development of wood-destroying fungi in the tree. Even where the dead and decayed wood of the stub remains intact, such organisms readily find their way into the tree. Thus, the most obvious reason for pruning shade and ornamental trees is to get rid of the diseased and dead branches, because when they are not removed bark-killing and wood-destroying fungi eventually gain entrance into other parts of the tree where they continue their work of destruction. Insects are one of the most common carriers of the spores (seeds) of fungi. Insects which inhabit diseased and dead parts of the tree carry the spores of fungi which are inimical to the tree: for example, the European elm bark beetle is the chief carrier of the deadly Dutch elm disease. Pruning, therefore, is a very necessary phase of tree sanitation.

It is sometimes necessary to remove living branches, especially where there is chafing or rubbing. Street trees require the pruning of live branches for the sake of shapely development and to prevent interference with traffic. In this connection, it should be remembered that, whenever possible, pruning should be done in the dormant season. Callusing of the wounds will begin more quickly in our broad-leaved trees when pruned just before or soon after growth begins. Also, where a number of living branches are to be pruned off, it is important that the operation should extend over a period of at least two or three years, or until the desired form of the crown has been attained.

The final phase in the removal of branches from a tree consists in protecting the wounds with an antiseptic dressing to prevent drying out as much as possible and the entrance of wood-destroying fungi and insects. The subject of proper dressings for wounds in trees is still unsettled. When not thoroughly treated and kept completely coated with a good antiseptic until callused over, wood-destroying fungi almost invariably enter the wound and sooner or later cause destruction in the bole of the tree. Figures 4, 5 and 6 illustrate what happens so frequently when pruning or other wounds on trees are not treated with a good antiseptic and properly cared for until completely callused or healed over. Too frequently when wounds are covered with an antiseptic dressing at the time of the removal of the

branch, they receive little, if any, further attention. Such wounds usually crack open later, thus making it all the more possible for the entrance of destructive fungi and insects. The wound shown in Figure 5 was treated with an antiseptic soon after the branch was removed, but received no further attention.

It is important to bear in mind the fact that all of our shade and ornamental trees are growing in artificial environments where there is, as a rule, a deficiency of mineral and other food materials. They have all come directly or indirectly from the forest. The writer has found that the trees in many artificially established forests, while apparently vigorous, are not so highly resistant to destructive fungi and insects as are trees which have developed where the seeds have fallen. Since this is true, may we not expect at least as great, if not greater, susceptibility to attack from these organisms in our shade and ornamental trees as in individuals of similar species under natural forest conditions? Wounds on our shade and ornamental trees cannot be expected to heal so readily as if these same individuals were under good natural forest conditions. The fact that our shade and ornamental trees are in artificial environments does increase the hazards of disease and other injuries and the necessity for judicious pruning as well as the proper care of their wounds. If there are sufficient water and nutrient materials in the ground, other factors being equal, the necessity for pruning will be reduced to a minimum. Wounds in vigorous trees will heal much more rapidly when properly protected than in an impoverished tree.

The inadequacy of our present knowledge of pruning, as well as other phases of arboriculture, is due in a large degree to practically a total lack of carefully prepared case records, which must necessarily be kept over a long period of years. Until this is done, the pruning of trees will remain a matter of wide controversy and opinion. There is abundant literature on the methods of pruning of shade trees, but there is little to be found on the actual results achieved. With ample case records, the pruning of our shade and ornamental trees will become established on a far more sound scientific basis than is true at the present time. The securing, keeping, and interpreting of these data is a problem for individuals who are trained and experienced in how a tree lives, the requirements, habits of growth, and its environmental relationship.

In Philadelphia and its environs is a wide variety of trees which are of foreign origin. The vast majority of these trees are on estates, many of which are among the very finest in America. The men who are entrusted with the care of these estates are confronted with a great many questions relative to the pruning of exotic trees as well as of our own native species.



FIG. 5



FIG. 6

Fig. 5. A neglected wound of four years' standing on a tulip poplar tree, showing the fruiting bodies of a wood destroying fungus, *Polyporus gilvus*. The cut was properly made and a good callus is forming.—Fig. 6. An old pruning wound on a paper mulberry tree, showing the fruiting bodies of a common wood destroying fungus, *Pleurotus ostreatus*. This wound was never treated.

Some of the problems in this connection are: What is the best time of year for pruning? No one season will apply equally well to all of the various species and varieties of trees. Where and how should the cuts be made? What kinds of tools should be employed? How should the wounds be treated? What kind of treatment, if any, should a pruned tree receive? What will be the rate of callusing of the wounds on each species of tree? The rate of callusing on the individuals of a species?

Many of our shade-tree ailments have their origin in unscientific pruning and care of tree wounds. The perfection of our present methods of pruning and other phases of arboriculture, whereby trees may be made to live longer and to retain their beauty and symmetry of form, can be realized only by scientific research on trees. A discussion of methods of pruning will follow in a later issue.

Harlan H. York,
Department of Botany,
University of Pennsylvania.

CURATORSHIP OF THE ARBORETUM

AN ARBORETUM, quite as much as a collection of paintings displayed in an edifice, constitutes essentially a museum, albeit an outdoor one. And generically at least, the problems presented by the two are not unlike. Among these are discriminating selection, determination of authenticity or identity, pleasing and artistic arrangement, skillful maintenance, protection against deterioration and possible abuse, fostering the enjoyment and educational benefits derived by the public from the collections, and the like. It is therefore appropriate that there has been established the Curatorship of the Morris Arboretum, carrying responsibilities similar to those associated with this long-recognized office in museums.

To fill this newly created position, the Arboretum has secured the services of Mr. Henry T. Skinner, who entered upon his duties in July of last year. A graduate of the Royal Horticultural School at Wisley, England, Mr. Skinner was for two years at the Arnold Arboretum in Boston, going from there to Cornell University. At the latter he has for some years been on the staff of the Department of Floriculture and Ornamental Horticulture in the New York State College of Agriculture, receiving in 1937 the degree of Master of Science in horticulture.

ACKNOWLEDGMENTS

THE ARBORETUM is grateful for the following presentations:

Ambler Nurseries,

Ambler, Pa.

7 plants of *Pieris* and *Quercus*.

Andorra Nurseries,

Chestnut Hill, Philadelphia, Pa.

54 plants of *Ginkgo* and *Ilex*.

Arthur Hoyt Scott Foundation,

Swarthmore, Pa.

76 plants of *Salix*.

Boyce Thompson Arboretum,

Yonkers, N. Y.

10 plants of *Cornus*, *Halesia*, *Malus* and *Ulmus*.

Cornell University,

Ithaca, N. Y.

1565 plants of *Arbutus*, *Azalea*, *Chamaecyparis*,
Juniperus, *Rhododendron* and *Tsuga*.

Henry A. Dreer, Inc.,

Riverton, N. J.

20 plants of *Buddleia* and *Tamarix*.

Eastern Shore Nursery,

Maryland.

3 plants of *Nandina*.

James I. George & Son,

Fairport, N. Y.

22 plants of Hybrid *Clematis*.

Huntington College,
Huntington, Ind.
2 plants of *Fraxinus*.

Morton Arboretum,
Lisle, Ill.
10 plants of *Quercus*.

Native Gardens,
Spokane, Wash.
3 plants of *Pachistima*.

Park Valley Nurseries,
Prospectville, Pa.
8 plants of *Chamaecyparis*.

Rose Manufacturing Company,
Philadelphia, Pa.
A supply of Triogen for use on roses.

Maurice Bower Saul,
Moylan, Pa.
3 plants of *Cryptomeria* and *Magnolia*.

Wharton Sinkler,
Elkins Park, Pa.
42 plants of Hybrid *Brassocattleya*, *Cattleya*
and *Laeliocattleya*.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Washington, D. C.
20 plants of *Abelia*, *Abies*, *Betula*, *Lonicera*,
Philadelphus and *Picea*.

Soil Conservation Service,
Washington, D. C.
141 plants of *Albizzia*, *Paliurus*, *Taxodium* and
Ulmus.

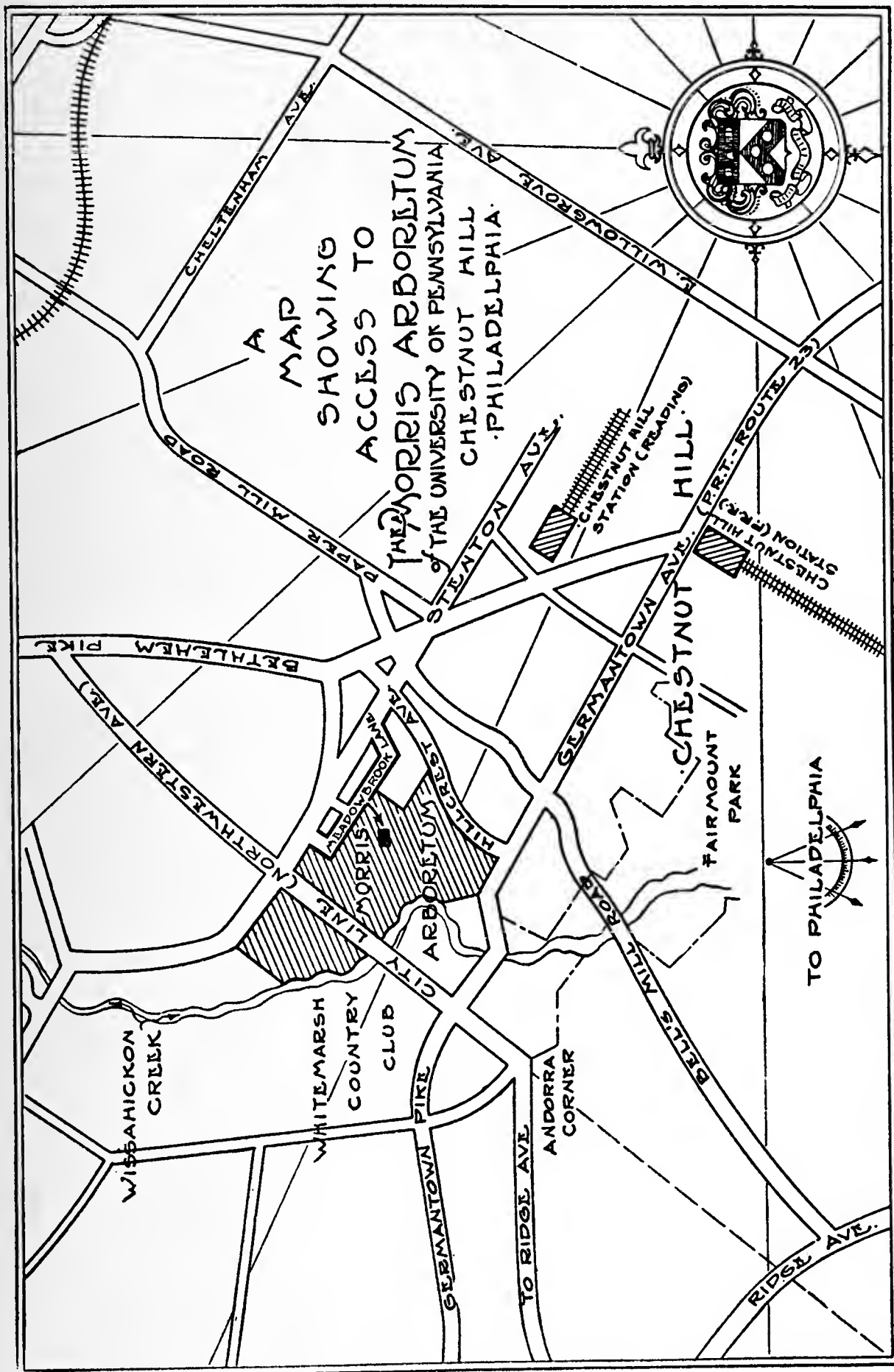
OPEN HOURS AT THE ARBORETUM

INAUGURATING a new policy on May 11, 1940, the Arboretum has since that date been opened to the public daily, including Sunday, from 9:00 A.M. until sunset. It will henceforth be closed only for the two holidays of Christmas and New Year's Day. Entrance for visitors is by way of the Main Gate on Meadowbrook Lane and the South Gate at Germantown and Hillcrest Avenues. The latter is readily accessible by bus from the Chestnut Hill bus and trolley terminal.

This extension of visiting hours has been reflected in a greatly increased public attendance throughout the past season, particularly during the Sundays and evenings of those periods when the grounds are perhaps at their best, in early summer and again for the foliage display of fall.

COVER DESIGN

THE COVER design represents the Mercury Temple at the end of the South Lawn. It is a pen rendering made, together with the frontispiece photograph, by Gustave Liebscher.

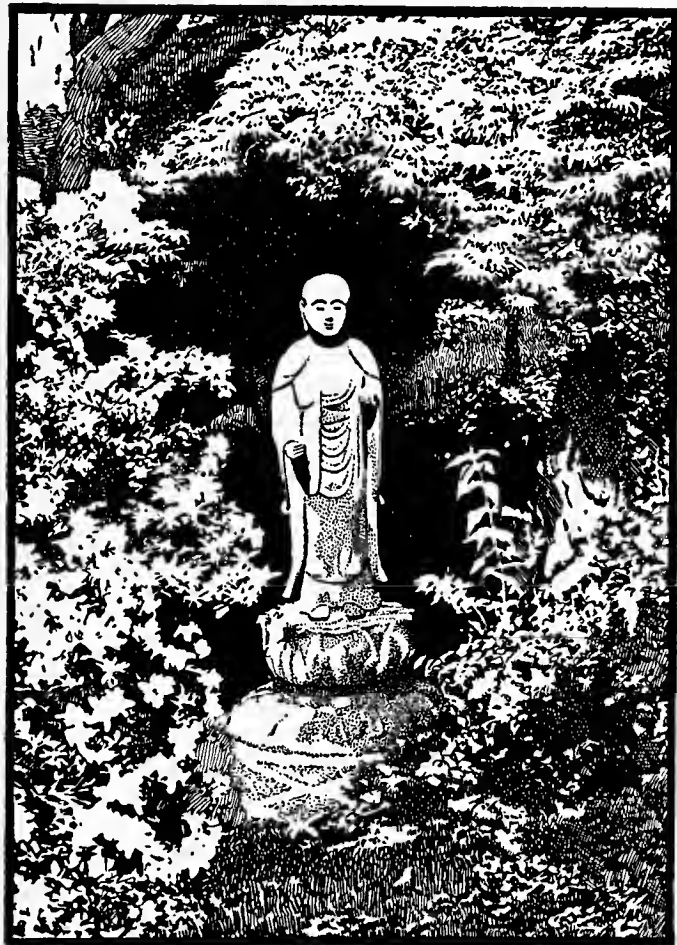






ARBORETUM BULLETIN
OF THE
ASSOCIATES

MAY, 1941



THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

THE MORRIS FOUNDATION
Maintaining THE MORRIS ARBORETUM
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UNIVERSITY OF PENNSYLVANIA

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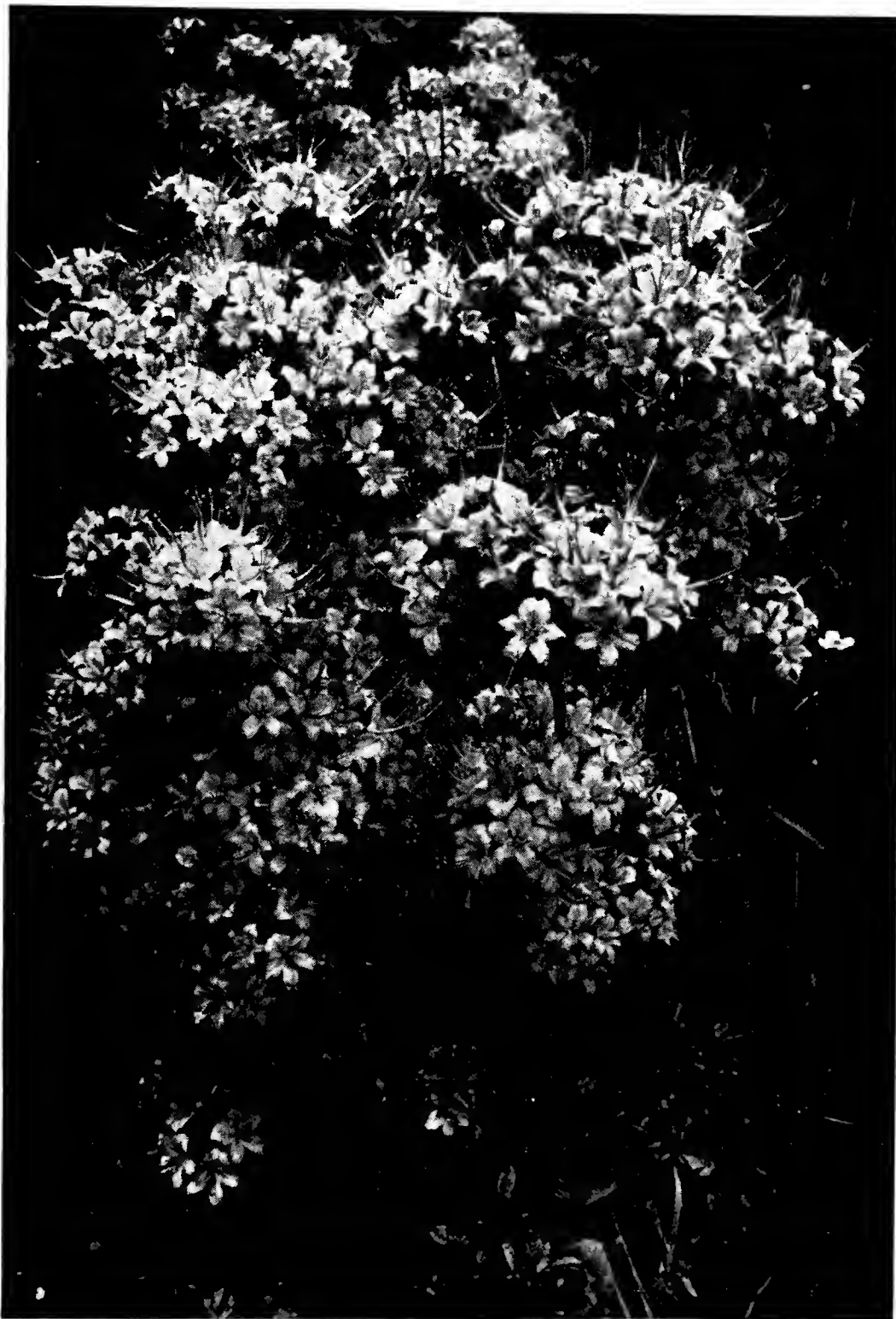
Curator

Henry T. Skinner

† Deceased.

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THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA



Rhododendron speciosum always excites
comment on its conspicuously handsome flowers

(See page 42)

GROW MORE NATIVES *

WE ARE indeed fortunate. Nature has endowed our country with a most magnificent native flora. But does the average American gardener appreciate this dower? Alas, a thousand times to one the answer is no.

On the other hand, the British gardener is vastly interested in our floral treasures, and annually spends large sums in acquiring such shrubs and plants as are available. This is especially commendable when one considers that theirs is a cooler climate than ours and American plants require a hotter sun than they can offer. As a rule, our plants do not thrive as well in Great Britain as do those from the Asiatic mountains, from whence such splendid plants have come in recent years. On more than one occasion, I have heard complaints from distinguished British gardeners that it was easier to obtain plants from Asia, or almost anywhere else, than from America! They are well posted and know we have all sorts of wonderful shrubs and plants that are still unknown in cultivation, but "How," they say in despair, "can they be obtained?" The average American nurseryman carries out-of-date plant material and there is mighty little variety in the stock. American gardens are greatly the poorer because of this. Travelling through the country, one marvels at the tiresome similarity of the flowers and shrubbery of most gardens.

For many years, in an earnest endeavor to help correct this situation, it has been my privilege to tramp over various sections of the Atlantic Coastal Plain of the Southland, in search of rare and beautiful native trees, shrubs and plants. Frequently I have wandered for miles along little known rivers. Then sometimes I am lured to flounder in lonely swamps often with water and mud seeping over the tops of my hip boots. The plants have always proved to be more than worth the effort. Hills and mountains too of other geologic provinces have been searched on some thirty plant collecting trips to the Southeastern States. The results of these journeys have far exceeded my fondest anticipations and my most ambitious dreams, for the beauty and variety of some of our little known native plants defy description. It is most gratifying that these shrubs and plants have made themselves thoroughly at home at Gladwyne. They require almost no care when once established in a congenial spot. They thrive in our hot summers, and our wet and

* *Editor's Note.*—The Morris Arboretum feels fortunate in being able to present this article by Mrs. J. Norman Henry, to be concluded in the next issue of the Bulletin.

As a field botanist with a very personal knowledge of American plants native to numerous special areas of our country, no less than as a real horticulturist, Mrs. Henry's name has become widely known and respected.

Photographs illustrating this article are by Josephine de N. Henry.

changeable winters have no terrors for them at all. Providing we are wise in our selection of plants, the soil we have to offer is usually satisfactory with little or no fixing or fussing. There is no doubt that the average American plant is a better grower and a longer-lived inhabitant of our gardens than the average foreigner.

The day must come, and let us hope it will be soon, when gardens will not be tolerated which contain shrubs and plants "dolled up" in dismal shrouds and bur-laps during the winters. Such doleful objects make our gardens sorry sights, whereas they should contain some beauty in winter as well as summer. We can never have showy winter flowers in our climate, but we *can* have beauty and variety in ever-green foliage and the attractive winter rosettes of many herbaceous plants. There is lively color, too, in the stems and barks of certain trees and shrubs. These latter are conspicuously beautiful when snow is on the ground.

Our foremost duty, if we grow native trees, shrubs and plants, is to grow them from seeds, instead of robbing the wild. If we purchase "collected" plants, we pay someone else to do our robbing for us. If we must buy plants we should see to it that the nurseryman propagates them from seed, cuttings or divisions. Even trees and shrubs are easily raised by this method. In these days vast operations are accomplished by the unskilled labor of the CCC's, and in the south, the prison gangs' irreparable harm to our native vegetation is often accomplished in an incredibly short space of time. Lakes and swamps are often filled to the level or, what is just as bad, sometimes they are drained. Either of these operations on the countryside will destroy the natural vegetation surrounding them. It is in just such places that so many of our most precious treasures make their abode. Among these latter are lilies and orchids. Then, too, the repeated burnings of underbrush in woodlands, in many instances, has completely wiped out whole stands of choice varieties of native azaleas, and so the deplorable story goes on.

Seedling azaleas will often bloom when less than three years of age. The collecting of seeds of our native azaleas is of far greater importance than collecting the plants. There are numerous varieties of the different species and many of these varieties possess very definite horticultural value. It is especially necessary to perpetuate these varieties before they are totally destroyed.

The glorious Halesias (Silver Bell Trees) are among the grandest and most ornamental trees of the American forests. Eighty- and ninety-foot specimens of *Halesia monticola* on the Carolina mountainsides in full bloom, with their snow white bells all strung along their branches, form a sight not easily forgotten. Fortunately for us gardeners, this grand tree is easily raised from seed and blooms

when very young. I found a beautiful pink-flowered variety (see Fig. 1), also another distinctive one with blossoms colored a "café au lait." *H. parviflora* is a pleasing shrub. *Styrax grandifolia*, a small tree and a relative, is an important beauty. Its white flowers are as sweetly scented as orange blossoms. Although not so hardy as *Halesia*, it succeeds here. The little shrubby *S. americana* is a gem of the highest class. It bears its deliciously fragrant white blossoms abundantly.

Malus angustifolia is one of our most beautiful crabapples, yet it is scarce in our gardens. *Crataegus apiifolia* has leaves of exquisite grace and laciness. When covered with its mantle of white flowers it is more than passing fair. The little *C. uniflora* is a delightful small shrub, with comparatively large white flowers that are borne singly. It comes quickly from seed.

Stewartia pentagyna, *S. malachodendron* and *Franklinia alatamaha* are beautiful small trees belonging to the tea family and bearing large white flowers like camellias.

Aesculus octandra is an attractive tree with yellow flowers.

However, when all is said, I rather think if I had room for but one small tree, it would be *Magnolia virginiana*, our superlatively lovely native magnolia.

Among shrubs *Cyrilla racemiflora* is unusual and beautiful and bears exceptionally handsome foliage as well as pretty white flowers.

Hamamelis macrophylla blooms several weeks after *H. virginiana* and is therefore probably our latest flowering shrub. *H. vernalis* (Fig. 2) is a fragrant winter flowering witchhazel and its flowers are warmly welcomed on a mild January day. In addition to yellow-flowered forms there are several attractive red-flowered plants at Gladwyne.

Viburnum alnifolium is perhaps our finest native species and it can hold its own with the best of the foreigners.

An enchanting *Calycanthus* from Georgia is a dwarf grower and bears pink flowers.

There are many magnificent hollies that are well worth growing, among them *Ilex verticillata padifolia*, *I. laevigata*, *I. monticola* and *I. coriacea*. The yellow-fruited form of *I. verticillata* is most attractive, so is the yellow-fruited *I. opaca*.

Salix tristis, in spite of its name, is a sweet and dainty willow whose little branches are covered with tiny gray silky "kittens" each spring. Its full height is only about 24 inches.

Anyone fond of miniatures would enjoy *Quercus pumila*, a tiny oak that often produces its pretty reddish catkins and little acorns when but 12 or 18 inches high!

Had I room for but six shrubs, *Zenobia pulverulenta* would surely be among them. The perfection of its chaste and exquisite white bells would be difficult indeed to improve upon. It does best with some shade.



FIG. 1.



FIG. 2.

FIG. 1. *Halesia monticola*. This pink flowered variety is a very striking beauty.—FIG. 2. *Hamamelis vernalis*. The deep red flowered variety is beautiful against the snow in January.

Lyonia lucida, a relative, is another beauty, especially the form with crimson buds that open to bright pink flowers. This one does best in full sun.

Elliottia racemosa, a rare and illusive beauty native to Georgia, has been growing here for years. It seems perfectly hardy and it produces its flowers regularly each season.

The white fruited variety of *Vaccinium nitidum* is indeed an enchanting little shrub, hardy as the proverbial "rock" and always excites great interest.

The deciduous Rhododendrons, or Azaleas, as they are still called by many, have been left to nearly the end of this very brief list of shrubs. The reason for this is simply that it is quite impossible to give any but the very slightest idea of their extraordinary variety and great beauty in any abbreviated account.

Many trips have been taken by the writer with this group of shrubs as the objective. Seeds, suckers and divisions have been brought home from most of my trips to the southeastern states. *Rhododendron cumberlandense*, recently described in "Rhodora" as a new species, is undoubtedly one of the most magnificent of all American shrubs. Words cannot do justice to the amazing rich red tones of its blossoms. I collected this one in 1936. Specimens of *R. speciosum* (see frontispiece) from various localities are growing here. Contrary to the usual descriptions of this species, the flowers are frequently of orange shades. The most attractive colors, however, are the clear vivid reds. When these are in bloom scarcely a stem or leaf is visible from base to top of plant. *R. austrinum* (Fig. 3) always makes another spot of marvelous color in the wild garden. Fragrance is an



FIG. 3. *Rhododendron austrinum* has been growing at Gladwyne for many years.

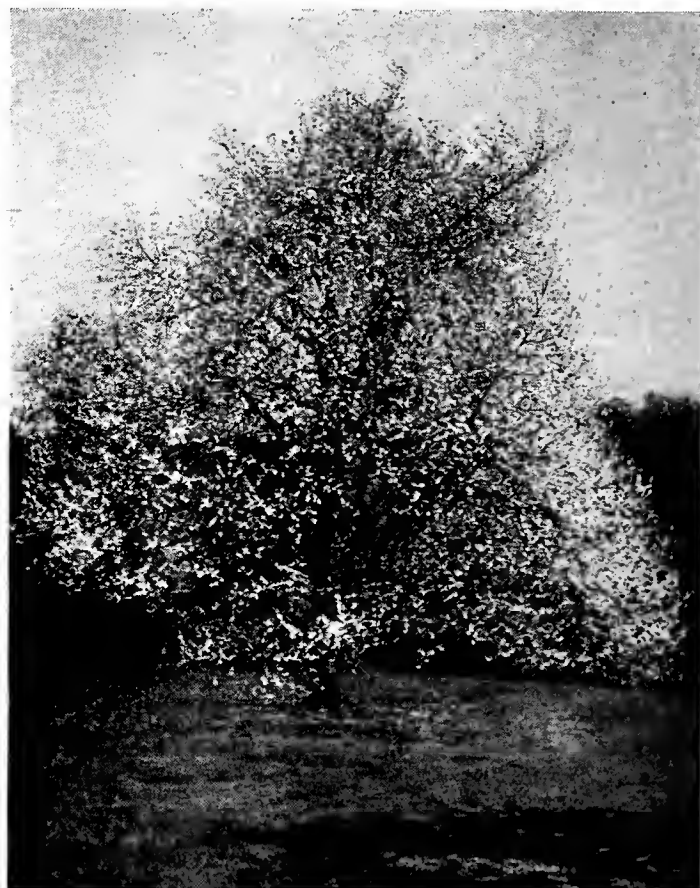


FIG. 4. *Halesia monticola* at the Morris Arboretum. This is an especially large flowered form and is now 32 feet high.

added charm, the only one in this orange colored group to possess it. *R. canescens candidum* is an absolute "must have" for everyone who sees it. It is a magnificent azalea and very floriferous, producing large showy clusters of white and delightfully perfumed flowers. Other rare and beautiful native species are here, too.

Only one evergreen Rhododendron will be mentioned in this little sketch, but it is a gem "of the first water," namely *R. Chapmanii*. It is a medium-sized shrub with comparatively small flowers of an exquisite shade of pure pink, with no tinge of magenta. Sometimes pale pink but often in deeper shades and always fine, *R. Chapmanii* has been growing here for over six years.

None of these plants receives protection of any kind whatsoever after it becomes established in its new home and the foregoing shrubs have withstood the rigors of the recent cold winters.

These rare and amazingly beautiful shrubs should be gracing our gardens more frequently. They are almost our next-door neighbors. Let us welcome them as such to our gardens.

(To be continued)

—Mary G. Henry

Gladwyne, Penna.

ONE HUNDRED THOUSAND BELLS

YES, THIS is the approximate number of nodding white "bells" carried this year at the Arboretum by the largest specimen of *Halesia monticola* (Fig. 4), the Silverbell or Snowdrop Tree—a magnificent sight provided by this plant which ranks among the handsomest of all our flowering trees.

In view of the great decorative value of the Silverbells it is difficult to understand why they have not been more widely planted, unless merely perhaps because they are American natives which, like so many others of their kind, have been sadly overlooked. There are probably more in cultivation in the Philadelphia region than elsewhere in the country, but in spite of this there are far from enough.

The genus *Halesia* was named in honor of Dr. Stephen Hales, the English author of a celebrated work on "Vegetable Staticks," who lived from 1677 to 1761. It belongs to the family *Styracaceae* and is related to another bell-flowered tree of our gardens—the dainty Storax or *Styrax*. Four species of Silverbell are all

native to the Eastern United States. *Halesia carolina* is a very showy plant of more or less bush habit, which reaches a height of about 30 feet in the lower lands of West Virginia to Florida, Texas and southern Illinois; *H. monticola* is native to forests of the higher mountain slopes where it not uncommonly attains a height of 80 or 90 feet. Apart from this difference of habit and the slightly greater flower size of *H. monticola*, it is very difficult to distinguish from the foregoing species, particularly under cultivation; *H. diptera* as seen in gardens is usually characterized by fairly low and bushy growth, and later May flowering than either of the foregoing species. The fruits carry two rather than the four prominent wings of *H. carolina* and *monticola*. It is not quite so hardy in the north and seldom carries as generous a flower display. The fourth species, *H. parviflora*, also from the Southern States, is of shrub habit, with rather small flowers, and extremely rare in cultivation. It is evidently not very hardy in the north.

Some half-dozen forms or varieties of the Carolina and Mountain Silverbells have been recognized, but with one or two exceptions they are of botanical rather than horticultural interest. *Halesia carolina* var. *dialypetala* is distinguished by the deep division of its petals almost to the base; var. *mollis* has extra broad and pubescent leaves. Var. *Meehani* is a very distinct low-growing form with abundant small flowers and wrinkled leaves, which originated as a seedling from *H. carolina* in Meehan's Nursery in Germantown, Philadelphia, somewhere around 1880. It is now seldom seen in cultivation. Of the Mountain Silverbell, var. *vestita* is distinguished by its rounded hairy leaves, and var. *rosea* by its pale pink flowers. Elsewhere in the Bulletin Mrs. J. Norman Henry mentions another pink variety and one with "café au lait"-colored blossoms, which she has discovered and introduced to gardens.

The Morris Arboretum is fortunate in possessing some unusually fine specimens of this highly ornamental genus. A fine tree of Mountain Silverbell (*H. monticola*, probably var. *vestita*) has attained a height of 32' 10", a spread of 42 feet and a trunk diameter of 18". Its branches sweep the ground, the flowers are large, of purest white, and, in full blossom on May 1 this year, it was a magnificent sight. A specimen of *H. diptera*, to the north of the Japanese Garden, is probably one of the biggest to be seen anywhere in cultivation. This, perhaps unusually, is of decided tree habit. It is now 42' 7" high, with a spread of 31 feet and trunk diameter of 2' 4". A second plant of the Mountain Silverbell, bushy in habit since the freeze of 1934, is about 23 feet high and 25 feet across. Among the smaller specimens is one of *H. carolina* of decidedly spreading form.

In the Philadelphia region these handsome plants do not, under normal conditions, seem to require any very special care. While tolerant of a fairly wide range of soils, they perhaps prefer one that is reasonably moist but at the same time well drained and not too shallow. At the Arboretum the finest specimens are to be seen in a sunny position on a sheltered southern slope, but this should not imply a need for coddling. Many excellent Silverbells are to be found flourishing in a hardier climate than our own—in Boston, Massachusetts; in Rochester, New York; in Cleveland, Ohio, and farther north yet. In these regions a sheltered position is more necessary than with us.

As still to be classified among the less common ornamentals, the Halesias or Silverbells are well worthy of the attention of anyone who is interested in first-class decorative plants.

Henry T. Skinner

LECTURE TOURS AT THE ARBORETUM

THE ATTENTION of horticulturists in the Philadelphia region is drawn to the following lecture or "discussion" tours which have been planned for times when a wide variety of plants are in interesting stages of growth at the Morris Arboretum and when illustrative material for each type can be found in greatest abundance:

June 21, 1941.

PESTS AND DISEASES OF WOODY PLANTS

Leader: E. PORTER FELT, Director of the Bartlett Tree Research Laboratories, Stamford, Connecticut.

Dr. Felt gained public recognition as an authority on insect pests when occupying the responsible position of State Entomologist of the State of New York. Over a period of several years his many books and writings on this topic have made his name a national byword in the field of pest control.

October 11, 1941.

TREE AND SHRUB MAINTENANCE

Leader: HARLAN H. YORK, Professor of Botany, Department of Botany, University of Pennsylvania.

Dr. York's name is familiar to readers of the Arboretum Bulletin and in scientific literature in connection with his researches in the field of disease control and related subjects of tree fertilization, pruning, etc. The latter topics will be illustrated and particularly stressed.

This series has been designed chiefly for amateur gardeners, but everyone is welcome and is cordially invited to attend. There is no charge. Visitors are encouraged to bring along their problems.

All tours commence at 2:30 P.M. on Saturdays at the Administration Building and will last for about two hours. In case of wet weather individual meetings will automatically be postponed one week. In this likelihood, confirmation can be secured by telephoning Chestnut Hill 5232. The first two tours of this series on May 17 and June 7, devoted to landscape topics and led, respectively, by Henry T. Skinner, curator of the Arboretum, and Professor R. W. Curtis of Cornell University, brought together a good and keen group of horticulturists.

TREE PRUNING TOOLS

THIS PAPER, the second of a series in the Bulletin, embodies brief descriptions of the more important tools which should be employed in tree pruning.

SHEARS.—The equipment should include hand and pole shears. Hand shears should be used only on very small twigs and branches not more than $\frac{1}{4}$ inch in diameter; pole shears (fig. 12, 13) should be employed only where it is not feasible for the worker to reach otherwise the parts to be removed. Although cuts made by shears may appear to be smooth, these tools usually leave numerous small cracks in the wood and bruise, and sometimes tear, the bark. When such injuries are moist, the entrance of parasitic organisms is greatly favored. Lopping shears should never be used for the final cut.

Ax.—Cuts made with an ax frequently result in permanent injury to the tender tissues. The effects of hacking or chopping of branches from young white pines are seen in Figures 20, 21. These cuts were made in early July while the cambium was actively growing. The blow of the ax bruised and tore this delicate tissue. Naturally, there followed a dying of the cells in and adjacent to the cambium, leaving wounds which became infected by various fungi.

These effects were more pronounced in the case shown in Figure 20. The latter also became infested with a pitch midge, which lives in the resinous exudations of pine. Through its feeding upon the inner living tissues of the bark, it stimulates a copious flow of resin; and the wounds it made, though slight, became infected with fungi, which killed the bark and thus increased the possibilities of the entrance of wood-destroying organisms.

Saws.—There are quite a number of types of saws designed primarily for tree pruning. Those illustrated and discussed are among the more commonly used; other designs may be especially adapted for certain types of cuts. The exigencies of the particular case at hand should determine the kind of saw to be used in removing a branch. For small branches, a small sharp saw with a straight or curved narrow tapering blade and a pistol-grip handle will often be most useful (figs. 8, 9, 10). Such saws, principally the one which has a narrow pointed blade (fig. 8), are especially handy in removing branches which may be closely placed on the tree (fig. 16). The type with a 16-18 inch blade (fig. 14) may have certain advantages, but should be limited to small branches. For branches 1-3 inches, or slightly more, in diameter, a narrow pointed saw with a blade about 18-20 inches long

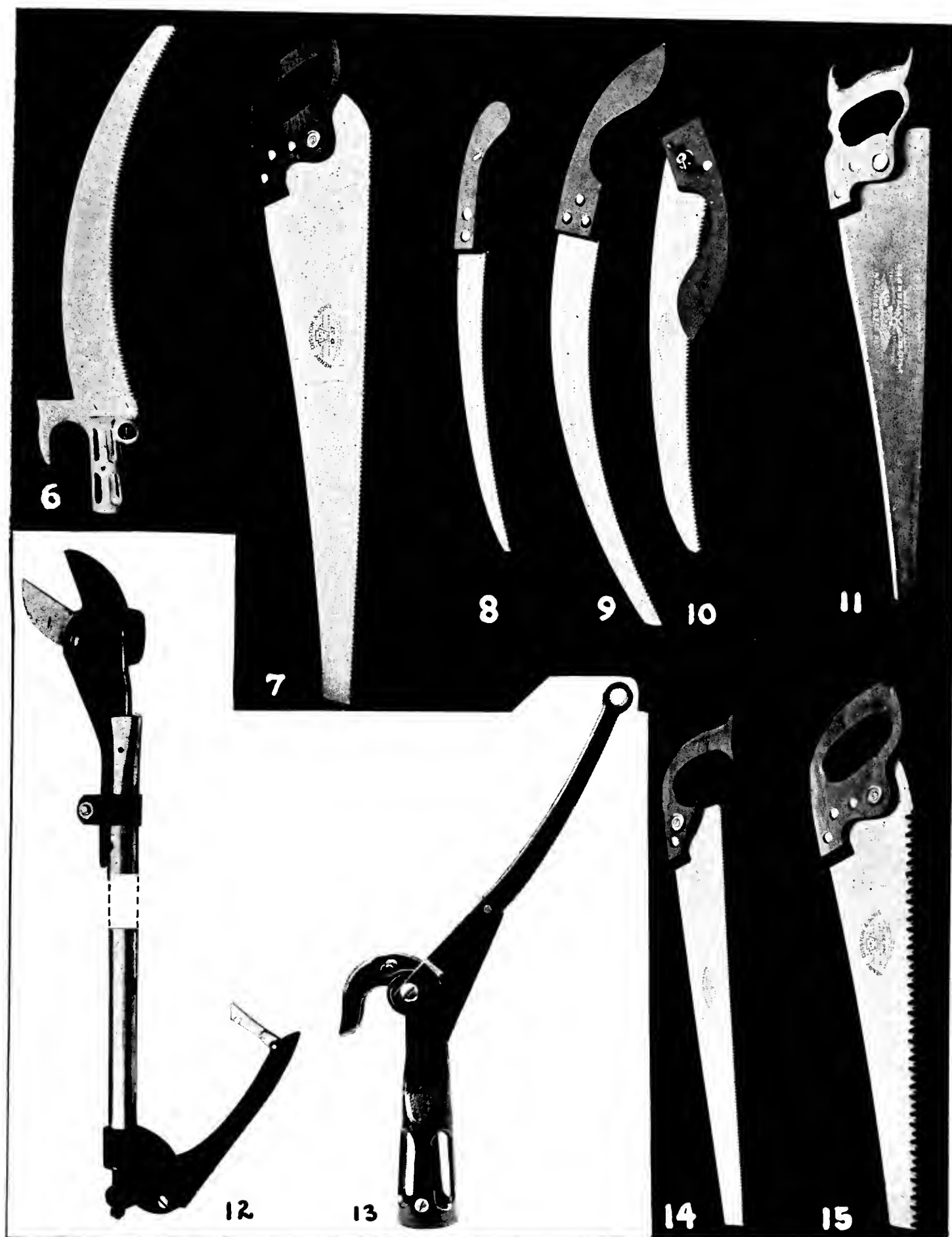


FIG. 6. A good type of pole saw.—FIG. 7. An excellent design for removing large branches.—FIG. 8. An excellent type of saw suitable for removing small branches.—FIG. 9. Same design as Fig. 8, only larger.—FIG. 10. Curved saw with a folding handle, which is desirable; the teeth in this type of saw are too large for most purposes.—FIG. 11. A "York State" pruning saw.—FIG. 12. The business ends of a 6-ft. aluminum handle pole pruner, well adapted for twigs and small branches.—FIG. 13. A good type of pole shears.—FIG. 14. A type of saw for removing branches less than $\frac{1}{2}$ " in diameter.—FIG. 15. A type of saw for heavy cutting.—(The tools shown in Figs. 6 and 13 were kindly lent by the F. A. Bartlett Tree Expert Company; those illustrated in Figs. 2, 7, 8, 9, 10, 11 and 14 by Henry Disston & Sons.)

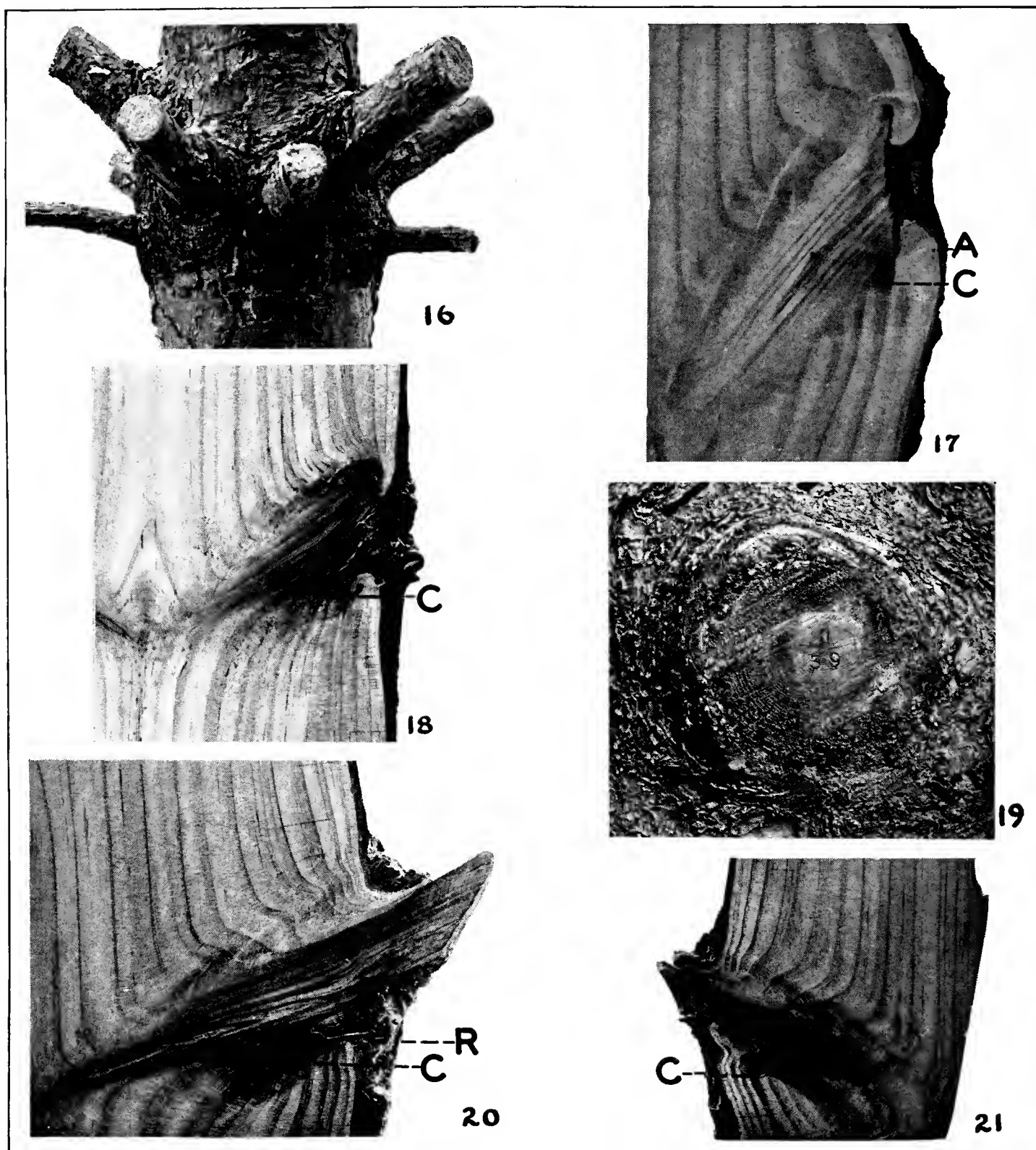


FIG. 16. A portion of the trunk of a young planted Scotch pine. There are 11 branches at this node. Note the crowded condition. The two smaller branches were dead.—FIG. 17. A view midway through a pruning wound on a young Scotch pine two years after the cut was made. Note the rough surface of the stub of the branch. This cut was made in December, 1937, when the cambium was dormant; section cut in late August, 1939. The dark area at C is due to an injury to the cambium being infected with fungi. A. The callus.—FIG. 18. A cut midway through a pruning wound on a planted white pine, taken 4 years after the branch was removed. The cut was made by a careless workman while the cambium was actively dividing. The stub, which was too long, was cracked. The injury at C was in the zone of the cambium. The dark color left of C is due to infection by wood-destroying fungi.—FIG. 19. A rough cut made with a saw (Fig. 14). The branch was about 2 inches in diameter. The cut should have been made with a saw like the one shown in Fig. 11 or possibly Fig 7. The heart wood has begun to crack open. The cut was made the middle of December, 1939, and photographed March 20, 1940.—FIG. 20. A similar cut made at the same time as the one in Fig. 21. C. Region of the cambium at the time of pruning. The heavy dark color at the left of this injury adjacent to the base of the twig indicates incipient decay. R. Heavy resinous exudate due to pitch midges.—FIG. 21. Radial cut through the node of a planted white pine tree pruned with an ax 4 years previously while the cambium was actively dividing (early

(fig. 11) can be used. It is known as the "York State Pruner" and is more of a general utility saw. For branches of greater diameter, larger and heavier saws will be necessary: the one shown in Figure 7 is widely used by experienced tree men, while the one seen in Figure 15 is designed for even heavier work.

Where it is not feasible to reach twigs and small branches near the outer extremities of the crown, it is often necessary to use a pole saw. The design shown in Figure 6 has all of the teeth pointing backward, and is used by many experienced tree men.

For most purposes, the number of teeth in a pruning saw should be not less than 7 per inch; on very large branches a saw with 6 teeth per inch, or one of the design seen in Figure 15, may be permissible. The coarser the saw, *i.e.*, the larger and fewer the teeth per inch, the rougher and more irregular the surface of the cut, thereby increasing the hazards from wood-destroying organisms. Saws with at least 8 teeth per inch are preferable for removing smaller branches. They are slower in operation, but they make smoother cuts. For conifers, *e.g.*, pines and spruces, fine-toothed saws may often become coated with resin; this should be removed with gasoline or kerosene.

It is important that saws be used by skillful operators. Figure 17 shows a branch 1 inch in diameter removed by an unskilled workman, though using a proper saw, similar to the one shown in Figure 11, with 7 teeth per inch. The cut was made two years prior to the preparation of the section. The nature of this cut and the injury to the cambium was such as to favor the entrance of fungi; in fact, they already had infected the darkened region at the lower margin of the cut. The results of using the wrong type of saw are shown in Figure 19. The branch was nearly 2 inches in diameter. A saw similar to the one shown in Figure 9 was used. The cut should have been made with a saw like the one illustrated in Figure 11, or possibly Figure 7. A rough unsightly cut was made unnecessarily. The rougher the cut, the more labor is required in treating the wound. From the cut shown in Figure 18, a branch nearly 1 inch in diameter was removed from a white pine with a saw similar to the one shown in Figure 7. The stub, protruding more than $\frac{1}{2}$ inch beyond the trunk, was cracked and the cambium severely injured. The darkened area to the left of C was infected with fungi. A saw of the design shown in Figure 11 should have been used.

July). C. The region of the cambium at the time of pruning. The heavy dark color at the left of this injury and adjacent to the base of the branch indicates incipient decay due to fungi.—(Figs. 16, 17 and 18 are used through the courtesy of the New York State Conservation Department and the Municipal Water Works of Rochester, New York.)

Climbing.— It is frequently necessary for workmen to climb trees. Expert climbers usually use ropes, but often it may be feasible to employ a ladder. If so, the lower ends should be provided with spikes, while the upper ends and the top rung should be bound amply with cloth to avoid injuring the tender tissues beneath the outer bark. Climbing by means of ropes during the period of cambium activity is open to question, especially where the bark is fairly thin. Workmen should wear soft rubber-soled shoes. The importance of avoiding injury to the cambium cannot be over-emphasized. A slight bruise, let alone a break in the bark, provides an avenue of entrance for wood-destroying fungi and insects. A warning against the use of spurs in climbing trees may not be out of place. Spur injuries may often be unsightly, and they invariably open up avenues in the bark for the entrance of wood-destroying organisms.

Sterilization.— One of the most obvious reasons for pruning is the removal of diseased and dead wood. Accordingly, the tools employed should be kept as sterile as possible. The fungous enemies of trees may often occur in the form of spores and hyphae on the outer surface of the bark and within the tissue of their hosts. Hence, these bodies often find lodgment upon the pruning hook and saws, particularly if the cut is made in diseased and dead wood. Thus, parts of fungi, as well as bacteria, may be transported easily—even long distances—and unwittingly transferred to the tissues of new and disease-free hosts.

One of the safest, best, and fairly inexpensive germicides for pruning tools is denatured alcohol, which may be carried in metal containers large enough to permit complete submergence of the tools.

Harlan H. York,

*Department of Botany,
University of Pennsylvania.*

COVER DESIGN

THE COVER design, representing a scene in the Japanese Garden, is a pen rendering made, together with the photograph of Figure 4, by Gustave Liebscher.

THE ORIGIN OF HORTICULTURAL FORMS IN CULTIVATED CONIFERS

EXHIBIT OF THE MORRIS ARBORETUM AT THE
PHILADELPHIA SPRING FLOWER SHOW

SEVERAL SPECIES of conifers have naturally, or in the course of a century or more of cultivation, when spontaneous variations are readily recognized, yielded a wide and diverse variety of horticultural forms. Some of these forms are so different in color, habit or type that it becomes hard to realize that they have actually been derived from one and the same parent species.

SPECIES, VARIETIES AND FORMS.—In horticultural usage the term “species” is applied to a naturally occurring group of plants which are similar in their important characters and which breed reasonably true from seed. Taking American Arborvitae, *Thuja occidentalis*, as an example, this is an Arborvitae of the genus *Thuja* and species *occidentalis*, a particular type native to this country and usually breeding true from seed. Yet, whether growing in the wild or under cultivation, certain individuals derived from these species will show variations in color, form or habit from the parent plant. If these variants breed true from seed they are normally classified as “varieties”; if they are seed variable and have to be vegetatively propagated by cuttings or grafts they are then given the lesser designation of “horticultural form” or “clon.” The Globe Arborvitae, *Thuja occidentalis globosa*, is thus a horticultural form of American Arborvitae (*Thuja occidentalis*) and, conversely, *Thuja occidentalis* is the parent species from which the smaller globe form has been derived.

THE ORIGIN OF HORTICULTURAL VARIETIES.—Variations in plants of this type may be due to any of three causes:

(1) *Changes of environment.* Species growing under differing conditions of elevation, rainfall or soil may show quite marked changes in habit, color of foliage, etc. But since these changes are of the individual rather than of the race, they are probably never transmitted by seed, at least so far as is indicated by present experimental evidence.

“Geographical forms” have probably originated not as a direct result of change of environment, but rather represent the end products of long periods of natural selection—quite possibly well adapted to existence under the conditions of this particular environment, but the details of the relationship represent, in a sense, a purely chance evolution.

(2) *Those which are due to a recombination of hereditary traits as a result of cross pollination or hybridization.* The intercrossing of species and varieties is the most important general method of obtaining new and improved horticultural forms of cultivated plants. In conifers, however, this does not seem to have commonly occurred; the varieties are usually derived from a single species. But a notable exception is the Yew family and an example, *Taxus media Hatfieldi*, which is the product of a cross between the Japanese Yew, *Taxus cuspidata*, and the English Yew, *Taxus baccata*. Such plants of hybrid origin do not breed true from seed and hence must be propagated from cuttings or grafts.

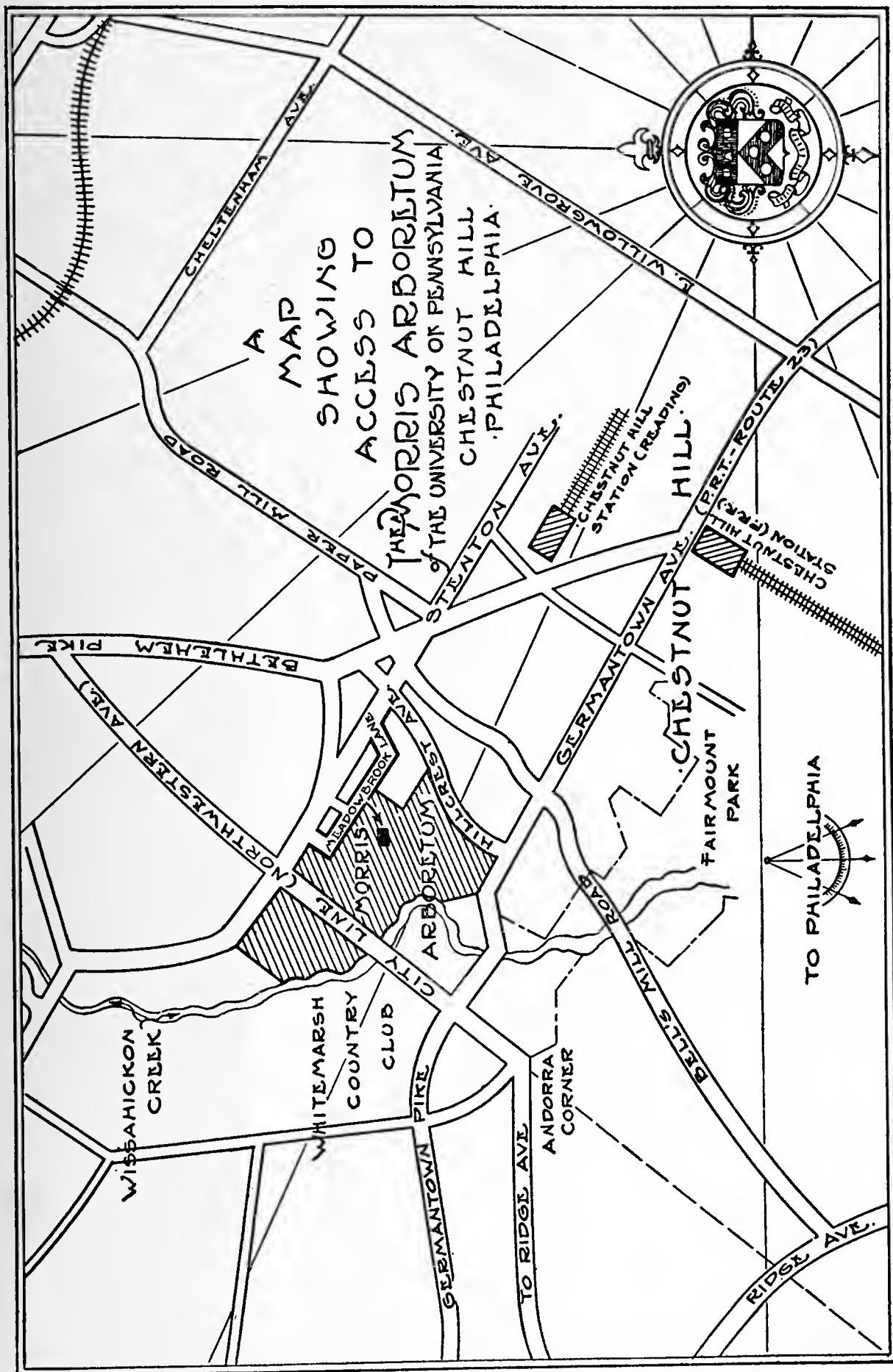
It should be noted, however, that even within a single species cross pollination between individuals may still result in some recombination of minor hereditary traits, producing a few individuals which may differ slightly from their parents. Most of the varieties of Japanese and English Yew (both true species) are seedling variants of this kind and again are propagated vegetatively.

(3) *Those due to mutations.* A "mutation" is a modification of growth or habit resulting from a sudden change occurring within a single growing cell of a seed or bud. The new individual may thus appear from seed or as a distinctively modified shoot or "bud sport" borne upon the parent plant. If detached and propagated, such a bud mutation may then be cultivated as a new horticultural variety. In such a manner many dwarf or distinct forms of conifers, such as the Dwarf Alberta Spruce, have arisen by the propagation of seedling mutations or, like the very low Maxwell Spruce, from those curious clustered bud sports or "witch's brooms" which quite frequently appear upon single branches of otherwise normal trees.

Seed or bud mutations occur relatively commonly among conifers and probably represent the chief mode of origin of many new variants. In a true mutation the genetic complex is affected and hence the new individual can be safely propagated by either seed or vegetative methods.

The above discussion formed the theme of the Arboretum Exhibit which received an Award of Merit at the Philadelphia Spring Flower Show. Nine species of Retinospora, Juniper, Spruce, Yew and Arborvitae were chosen as representative of the parent types of a selection of varieties and horticultural forms grouped in conjunction with them. The identity and relationship of these varieties to the parent types was indicated by means of explanatory labels and connecting colored strings. The plants were arranged in a pleasing landscape setting and evoked considerable interest on the part of Flower Show visitors.

Henry T. Skinner







ARBORETUM BULLETIN
OF THE
ASSOCIATES

SEPTEMBER, 1941



THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA

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THE MORRIS FOUNDATION
Maintaining THE MORRIS ARBORETUM
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The Arboretum Bulletin of the Associates is published quarterly at 187 College Street, Burlington, Vt., by the Morris Arboretum, Chestnut Hill, Philadelphia, Pa. Entered as second-class matter January 28, 1941, at the Post Office at Burlington, Vt., under the Act of August 24, 1912. Annual subscription \$1.00. Single copies 30 cents. Free to Associates of the Arboretum.

THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA



European Weeping Beech
A form of *Fagus sylvatica pendula* Loud.

FRONTISPIECE AND COVER ILLUSTRATION

THE TREE shown on the frontispiece is a form of the European Weeping Beech, *Fagus sylvatica pendula*, a fine 57-foot specimen growing in front of the Arboretum Administration Building.

This elegant tree is about as many years old as feet in height and spread and one of a few others of similar type apparently distributed in this region around 1890 by the then flourishing nursery of Thomas Meehan and Sons. The leaves of this unnamed form are somewhat smaller and rounder than the species and, while the branches are unmistakably pendulous, the general habit is more upright and more graceful than that of the common weeping variety.

The intricate branch pattern of this tree is as striking and decorative in winter as is its billowing foliage in summer. Growth requirements and possible weaknesses are essentially the same as those of the parent type.

The cover design represents the Lodge on Hillcrest Avenue.

The cover design and the photograph were made by Gustave Liebscher.

Henry T. Skinner

GROW MORE NATIVES

(Continued from page 43)

ANY PRAISE is superfluous to those who have seen the wild flowers in bloom on the mountainsides of the Southeastern states. Alas, the supply is fast diminishing and now it is only in remote sections that they are seen in abundance. The vegetation of the lowlands of the Coastal Plain is just as beautiful. Undoubtedly when many of these plants become better known, they will form a very solid "backbone" planting in our gardens.

Orchids will not be discussed in this little article because, unless the grower is willing to plant them in a permanent place and to expend considerable care on them it seems sheer plant murder to attempt their cultivation. Their use should be absolutely banned for "dish gardening" or glass globes. Other natives, such as *Mitchella repens* (Partridge Berry) etc., should be tabooed for this purpose also.

Our native lilies are splendid ornamentals. All are easily raised from seed. *Lilium superbum* is well named for it is one of the grandest bulbous plants we have. One hears so much of lily diseases these days and it is well-known that almost all lily bulbs on the market are infected with "mosaic," that incurable and deadly virus disease that is such a menace to all lilies. Grow *Lilium superbum* from seed and then you can have all the healthy bulbs you want, that are capable of outliving you and generations to come. For years I have been selecting fine forms of this grand lily. Here in Gladwyne is a deep blood red form, a pale uniform orange with faint spots and no shading of red and also a perfectly pure unspotted yellow. Matched with Ridgeway the color is "Light Cadmium." The fragrant *L. Michauxii* is a choice and easily grown lily also.

Trilliums, of which there are over forty kinds at Gladwyne, are among my favorites. It is hard to pass over them quickly. *Trillium Catesbaei*, both the pink and the pure white form, are among the most graceful of liliaceous plants. *T. erectum* is very variable and some of its color forms are most choice beauties. Especially, the pale pinks, a nice bicolored form and a white one with a purple edge to the petals. *T. Ludovicianum* is most unusual looking and *T. lanceolatum* is a rarity for the specialist. *T. maculatum* has amazingly handsome leaves variegated with dark green and silvery greens. *T. Vaseyi* is a bold and massive species with velvety maroon flowers, undoubtedly one of the noblest of them all. Until trilliums are propagated by seeds or vegetatively, no more than a few (five or six for instance)

should be purchased, for nurserymen often have to strip the forests in order to satisfy their customers.

Two eastern alliums are strikingly handsome small plants for the rock garden, *Allium oxypbilum* and *A. Cuthbertii*. Both with large heads of pure white flowers.



FIG. 1



FIG. 2

Fig. 1. *Trillium erectum*. Peach pink, yellow and pale red flowers are in the group at Gladwyne.—Fig. 2. *Allium Cuthbertii*. The pink flowered *Penstemon australis* is in the background.

The chaste and extremely lovely *Zephyranthes atamasco* is in effect a pure white amaryllis, to which it is a close relation. It is one of our most beautiful natives and yet is rarely seen in cultivation.

Amsonias must be selected with care but broad petaled varieties of distinct and clear tones of blue are conspicuously attractive plants. *Amsonia ciliata* is here with white and also clear turquoise and deep "Alice" blue flowers.

The large flower clusters of *Asclepias purpurascens* are colored an unusual shade of rich crimson, very different from the dull pink of the common milk-

weed. *Asclepias tuberosa* in addition to orange, sometimes bears pale lemon-yellow flowers and I have it also in several shades of true vermilion red.

Cassia hebecarpa is a native here. Its showy yellow flowers of unusual form and its pretty foliage make this a highly ornamental and desirable perennial. Best of all it can hold its own among rough weeds.

Aster linariifolius is a charmingly dainty little aster for the rock garden that is especially valuable for its late blooming season. The pink variety makes a nice contrast.

Among fall flowers the *Liatris* rank very high. *Liatris aspera sphaeroidea* is one of the most handsome plants of the North American Flora. It is a huge robust liatris up to five feet in height. The buds are just as ornamental as the large shaggy flowers, perhaps even more so, for the many broad rounded bracts on the unopened buds make the stems look as though they were strung with silver blossoms. In marked contrast other spikes carry buds of a striking and unusual shade of dark purple. *L. spicata* in addition to white comes in a pretty pale lavender. These two with the type color make a pretty group. *L. elegans* is showy and unusual. *L. squarrosa* has large individual flowers. There are other nice ones too. Four albino species are here.

Chrysogonum virginianum, a dwarf creeping perennial with golden yellow flowers, is one answer to the eternal question, "What can we grow in a dry shady place?"

The chelones are autumn flowering of very great value, and they are excellent rough and ready growers. *Chelone glabra* comes with both white and pale pink flowers, *C. Lyonii* has pink flowers, *C. Cuthberti* has flowers of a deep unusual shade of purple. The flowers, however, of *C. obliqua* are colored a rather harsh pink.

There are many, many penstemons. Over a hundred kinds were or are here. Many of the Rocky Mountain species are breath taking in their beauty, but many too are none too easy to grow in the east. However, some of our easterners are showy and they are not difficult to grow. The common form of *Penstemon hirsutus* is not especially attractive but the varieties are. One form has dark plum purple flowers with a white lip. Another has bright pink flowers with a white lip. Clumps of either of these are very fine. *P. dissectus* as well as being the handsomest penstemon native to the Eastern states is also the rarest. In fact, it is one of the rarest plants in the world, having only been found a few times. *P. Murray-*

anns is a magnificent plant with open mouthed scarlet flowers, a great improvement on *P. barbata*. Some of the flower stems of mine are over seven feet tall. This one is from Louisiana.

Delphinium tricornue is a splendid little plant.



FIG. 3



FIG. 4

Fig. 3. *Pblov Henryae* is in the foreground with *P. bifida*, one of its parents, in the rear.—Fig. 4. *Iris verna*. An albino form.

Disporum maculatum equals any orchid in grace and delicate beauty and is much easier to grow; it is a woodlander.

The white and pinky white varieties of *Dicentra eximea* are enchantingly lovely and most easy to handle. I found these on a Virginia shale bank.

So much is heard about the blue Gentians of Europe, why not try some of our own? The easily grown *Gentiana saponaria* makes an imposing display every autumn. *G. decora* is another beauty that ranges in color to white with pale blue or pink stripes. These variations of the flowers make them look as though they were

made of fine porcelain. *G. porphyrio*, that none-too-easy-to-grow beauty, has been here for years. Both the pink and the white varieties are stunning.

Then, too, there are many fine phloxes that should be seen in our gardens more often. *Phlox ovata pulchra* can hold its own with the best. *P. floridana* is an extremely rare and most beautiful phlox. This phlox, like many others, varies considerably. My variety has very large broad-petaled flowers of a nice pale pink. *Phlox Henryae* (Wherry) a chance hybrid of *P. nivalis* and *P. bifida*, first saw the light of day in my trial garden and bears flowers larger than either parent. The petals are deeply cleft like those of *P. bifida*. The color is a pastel pink.

The first time my eyes fell on the tall blood-red spikes of *Gilia rubra* they seemed to me to be almost too wonderful to be true and the foliage is uncommonly pretty. Yet they are easy to grow and self sow freely. These plants are biennials.

One wonders why that little treasure of all native irises, *Iris verna*, is so rarely seen in gardens. It has the qualities of brilliancy in color and fragrance, too. The white form is extremely lovely and so is another that is colored a pearly pale pinky lavender. These all have bright orange crests.

Silene virginica is a grand plant for a dry half-shady rock garden. The exquisite pale pink form is a very lovely and outstanding novelty. *S. regia* when in bloom and covered with its wonderful light scarlet flowers, creates an effect that for brilliancy can scarcely be duplicated. It has stiff upright stems that reach over a yard in height.

All the foregoing plants and many more rarities are growing here. Owing to being completely at home in our eastern climate and therefore always thriving happily in our gardens, it is to be hoped that these plants will soon cease to be "rare."

Not that we should ever forego our European favorites, far from it, but do let us at last make a little "standing room" for the plants who inhabited the land before we did. Let us give them a chance to grow, "a little spot under the sun," and make them welcome in their own homeland!

Each one of my plants brings a happy memory and I can easily see in my mind's eye the very place I found each one. Perhaps those plants I had to wade through deep swamps to reach, or those I found while being devoured by ticks, etc., or while dodging rattlesnakes, are those I like the best.

Mary G. Henry

Gladwyne, Penna.

RECENT CHANGES AT THE ARBORETUM

PHYSICAL PLANT

CERTAIN PHYSICAL changes are being made at the Arboretum. These are part of the gradual process of adjusting, where necessary, the beautiful home acres of Mr. and Miss Morris to the general educational and research objectives which these generous donors specified in establishing the Arboretum.

AT COMPTON the adjustments in progress concern chiefly the greenhouses and associated equipment, and some of the tender tropical and subtropical herbaceous collections which they housed. The latter, of which the fine collections of orchids, bromeliads, and anthuriums presented by Mr. Wharton Sinkler constitute the most important part, have been transferred to the greenhouses of the Department of Botany of the University of Pennsylvania. Here better facilities are available for caring for these plants. But more than this, in their new location they are more immediately available for instruction and research—the purposes Mr. Sinkler primarily had in mind in presenting the collections.

The old greenhouse unit which housed these collections is being dismantled. Its condition was such that the extensive repair and rebuilding which would have been necessary did not recommend themselves. Moreover, the range was poorly suited for the more pressing needs of the Arboretum. Accordingly a new inexpensive utilitarian greenhouse 11 x 62 feet is being erected parallel to and immediately to the north of the present “growing-on” house below the Fern Conservatory. This house, divided into two equal sections, will fill the present urgent Arboretum need for modern propagation and experimental research facilities. From a portion of the dismantled range, a suitable ventilated roof was refabricated to replace the old precarious sash roof of the small pit house adjoining the Fern Conservatory, thus restoring this useful unit to a good state of repair.

Across the west (lower) ends of the growing-on house and of the new greenhouse is being erected an attractive stone headhouse. Nestled against a steep wooded slope, it is inconspicuous and gives the impression of being but one story high though actually providing two full stories and a loft. The lower floor will provide a repair shop and storage space for mechanical equipment. In addition it will make available properly located and suitable headquarters and facilities for the men of the Arboretum. The upper floor will contain an ample work and potting room from which there is convenient direct access on the same level to the growing-on house and the propagating and research house. This floor also furnishes offices for

the head gardener and for records, a tool storage room, and in addition a small laboratory in convenient proximity to the research section in the new greenhouse.

The present greenhouses are heated by three separate boilers and systems. By slight and inexpensive adjustments and by installing two of the present boilers in tandem in one of the existing boiler rooms, all heating will in the future be supplied from the operation and servicing of one system and plant. This will have the additional advantage that in the event of a breakdown in one boiler, sufficient heat to prevent cold damage in all greenhouses can be supplied by the other in the tandem arrangement until repairs can be made.

AT BLOOMFIELD the changes in process constitute a beginning in the reduction in number of structures and the reconditioning of those to be retained. As acquired by Mr. and Miss Morris in 1913, the property included four houses, besides the mill on the Wissahickon, a barn, and numerous outbuildings. Operated as a farm until the death of Miss Morris in 1932, Bloomfield, with this full complement of structures, became, together with Compton, the Arboretum. With its present and permanent educational and research objectives, so generous an equipment in structures, especially residential, is not needed. The houses at Bloomfield will accordingly be reduced gradually to one, the latter to serve as the residence of the caretaker of this portion of the Arboretum.

Architecturally and as to location, it was everywhere agreed that the structure to be preserved is the "Miller's House." This very modest old colonial stone residence, together with the old grist mill and race nearby and the early bog iron hole also hard by, constitute a mellow harmonious ensemble of distinctly Colonial flavor. It is hoped that full advantage can be taken of the opportunity appropriately to integrate this unique area into future developmental plans of the Arboretum.

The miller's house, urgently in need of attention, is being repaired and made livable. Synchronously with these operations and those on Compton, one of the houses on Bloomfield is being taken down, the carefully salvaged materials largely entering almost at once on a second long period of usefulness in the Arboretum as major parts of the new and restored structures.

PLANTINGS IN THE ROSE GARDEN AREA

The rock walls on three sides of the formal rose garden are a never-ending source of delight to visitors in spring and early summer. They are extremely col-

orful, but yet from the educational standpoint their effectiveness for two principal reasons is somewhat open to question: the diversity of plants suited to this location is not nearly so pronounced as it might be in an area of this size and, with the exception of a few groups, no plants in these collections have borne labels. To remedy this situation a tentative list has been prepared of some 100 additional desirable varieties of wall plants likely to succeed with as little fussing as possible in this region; to date a majority of these have already been acquired as seed or plants from various sources and some are already planted. Mr. Rex D. Pearce, of Moorestown, New Jersey, has been particularly generous in supplying a large amount of this material. By next year emphasis upon a few standard forms of aubrietia, *Phlox subulata*, *Alyssum saxatile*, iberis, dianthus, and a few others, will be decidedly changed in favor, we hope, of a more prolonged blooming season and greater variety interest.

To solve the second problem, a majority of specimens of each plant variety are being supplied with small but easily legible stainless steel labels, designed for durability and specially treated to eliminate the glare effect of normal polished steel.

Since the Rose Garden undoubtedly forms the focal point of interest for this part of the Arboretum over a considerable part of the year, few changes in its present form are contemplated, at least for this season. As soon as possible, however, certain less desirable varieties will be replaced with popular improved forms to provide a better and longer show effect.

The second principal addition to the Rose Garden area is a collection of twenty-two varieties of clematis planted a year ago along the south and west balustrades, where they promise to create a fine display when in bloom. These "aristocrats of the Climbing Plants" were presented to the Arboretum by the well-known clematis specialists—James I. George & Son, of Fairport, New York—in the following varieties:

Ascotiensis	Lawsoniana	The President
Comtesse de Bouchaud	Lord Neville	Ville de Lyon
Duchess of Edinburgh	Mme. Baron-Veillard	W. E. Gladstone
Henryi	Mme. Edouard Andre	William Kennett
Jackmani	Mrs. Cholmondeley	Jouiniana, Spingarn variety
Jackmani rubra	Nelly Moser	montana undulata
King Edward VII	Ramona	tangutica obtusiuscula
Lady Betty Balfour		

Since Messrs. George & Son have signified their intention to add to these from time to time from their own collection of over sixty kinds, the Arboretum hopes eventually to possess a valuable planting of this interesting group for its visitors to study and enjoy.

J. R. Schramm

In Memoriam

IT IS with sincere regret that we record the death on July 22, 1941, of Ralph Caponigro, one of the oldest members of the Arboretum staff. Mr. Caponigro came to the Arboretum almost twenty years ago as gardener, when it was still the estate of Miss Lydia T. Morris. Since that time, rain or shine, he has made the long trip from his home on McKean Street to Chestnut Hill with an almost unbelievable regularity.

A faithful worker, a great lover of plants, and possessed of a persistent sense of quiet humor, "Big Ralph" will be greatly missed by all who knew him. He was sixty-seven years old and is survived by his wife, Mrs. Jennie Caponigro, four daughters and two sons.

FINAL LECTURE TOUR

THE LAST of the summer 1941 outdoor "discussion" tours is scheduled for Saturday, October 11. The topic is "Tree and Shrub Maintenance" and the leader—Dr. Harlan H. York, Professor of Botany in the University of Pennsylvania. Disease control as well as related subjects of tree fertilization, pruning, etc., will be particularly stressed. Upon this date fall colors at the Arboretum should be at their height.

These tours are free and everyone is welcome. The group assembles at 2:30 P.M. at the Administration Building. In case of wet weather the tour will be postponed one week. In this likelihood confirmation can be secured by telephoning Chestnut Hill 5232.

HERBARIUM ACCESSIONS OF WOODY PLANTS FROM 1938 TO APRIL, 1941

BY GIFT

Adams, J. W.—From Pennsylvania	271	Ludwig, Ernest—From New Jersey	1
Adams, J. W. and Myrtle T.—From Pennsylvania	25	Oliver, F. W.—From Canada and United States	60
Brubaker, Ethel—From Pennsylvania	76	Quidas, Fannie—From Caroline County, Maryland	16
Davis, Spencer H., Jr.—From New York and Pennsylvania	7	Schramm, J. R.—From Pennsylvania, Virginia and New Mexico	13
De Pue, Palmer—From Pennsylvania	100	Seifrizz, William—From Cuba	2
Fender, Flora S.—From New Jersey and Virginia	208	Spargo, Mrs. S. M.—From Texas	1
Fogg, John M., Jr.—From New Jersey, Pennsylvania and Virginia	246	Travis, Mildred T.—From Pennsylvania and Virginia	14
Fosberg, F. Raymond—From United States and Hawaii	313	True, Rodney H.—From Eastern United States	43
Glowneke, Stanley L.—From New York and Pennsylvania	63	Wagner, Paul R.—From Pennsylvania	68
Griggs, Mrs. E. C.—From Washington	10	Walker, E. Perot—From Labrador and Maine	127
Griscom, Mrs. William B.—From Florida	10	Watts, Hilton and Marie—From Maryland	20
Jenkins, Charles F.—Cones of Pinaceae from Western United States	7	Wherry, Edgar T.—From Eastern and Western United States	40
Kelley, Arthur P.—From Georgia and Florida	20	Wherry, Edgar T. and Adams, J. W.—From Pennsylvania and Maryland	375
Koster, Hollis—From New Jersey	32	Wherry, Edgar T. and Fisher, Mary J.—From Pennsylvania	12
Lambert, James and Bertha—From Canada and Western United States	123		

BY EXCHANGE

Arnold Arboretum—Miscellaneous	140	Purer, Edith A.—From Western North America	18
Breitung, August J.—From Saskatchewan, Canada	146	United States National Museum—Miscellaneous	88
Carnegie Museum—Miscellaneous	158	University of California—From California	238
Charette, Leopold A.—From Saskatchewan, Canada, and Vermont	120	University of Maine—From Maine	239
Chrysler, M. A.—From United States and Europe	23	University of Pennsylvania—Miscellaneous	32
Koch, Walo (of Zurich, Switzerland)—From Switzerland, etc.	127	Total	3,940
McFarlin, James B.—From Florida	27		
Missouri Botanical Garden—Miscellaneous	77		
The National Arboretum—Miscellaneous	204		

On April 18, 1941, the grand total of mounted and distributed specimens in the Herbarium was22,941

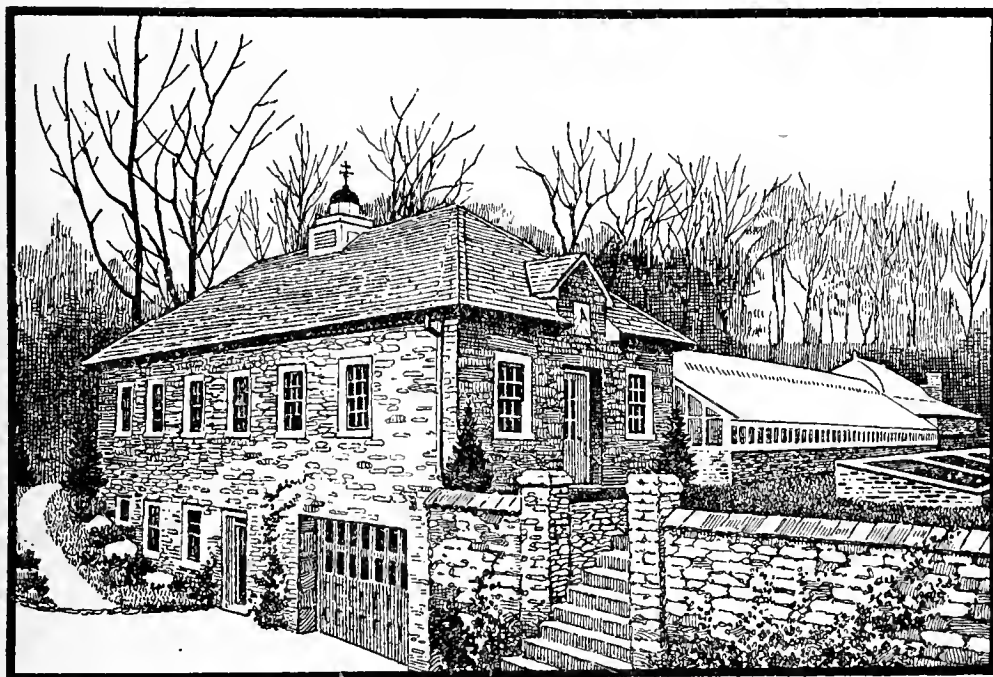
J. W. Adams





ARBORETUM BULLETIN
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DECEMBER, 1941



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MORRIS ARBORETUM
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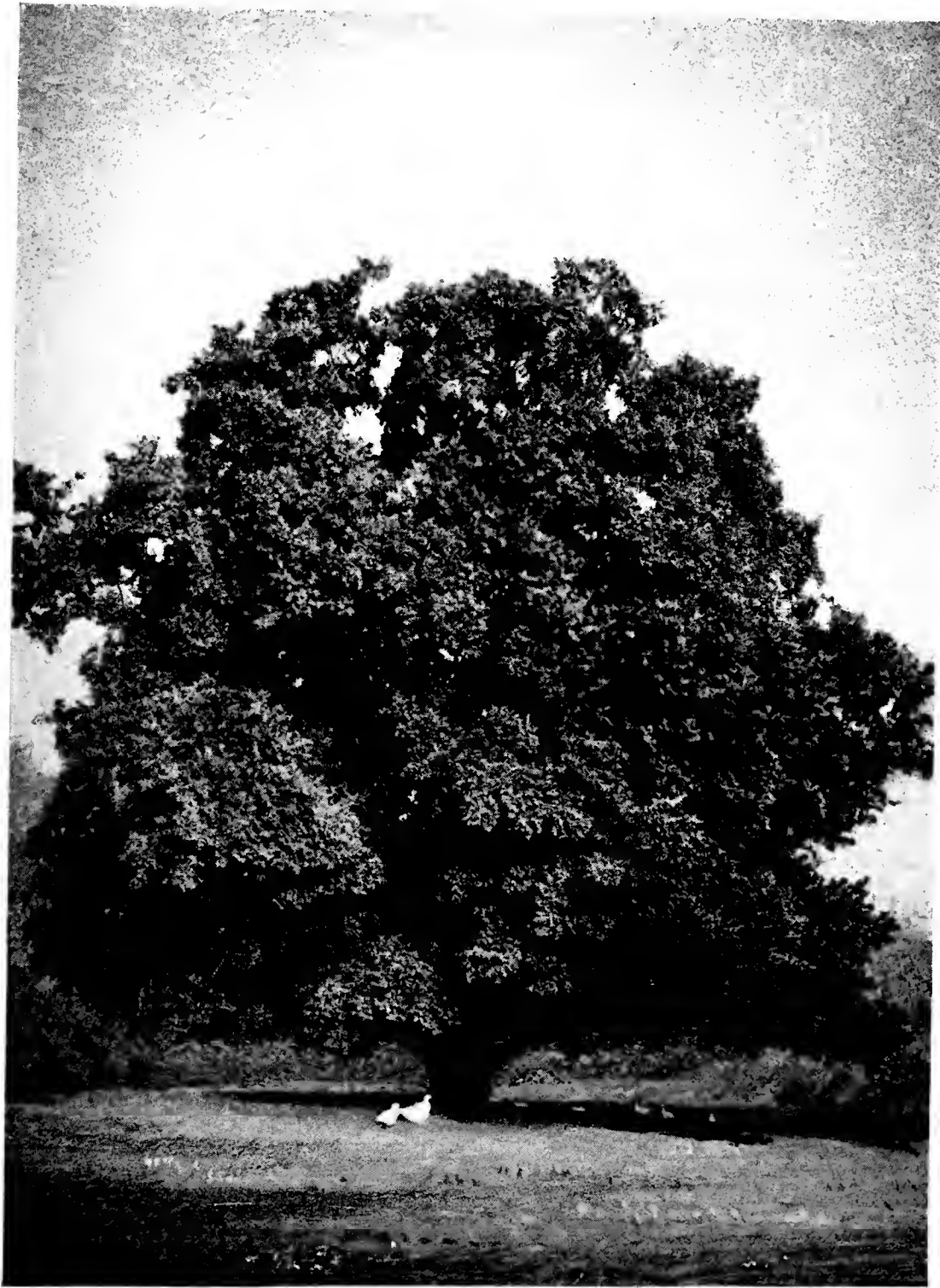
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Henry T. Skinner

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THE
MORRIS ARBORETUM
OF THE
UNIVERSITY OF PENNSYLVANIA



Chinese Elm
Ulmus parvifolia Jacq.

ARBORETUM BULLETIN—VOL. 3, NO. 21, DECEMBER, 1941

FRONTISPIECE AND COVER ILLUSTRATION

THE TREE shown on the frontispiece is the true Chinese Elm, *Ulmus parvifolia*. This specimen, measuring some forty-two feet in spread and fifty feet in height, is growing at the Arboretum on the north side of the Swan Pond.

Ulmus parvifolia is native to North and Central China, Korea and Japan, and was introduced in 1794. It is not common in cultivation but is nevertheless frequently confused in horticulture and the trade with the Siberian Elm, *Ulmus pumila*, which is often referred to by the name of "Chinese Elm." *U. pumila* is a native of Eastern Siberia, Manchuria and Korea and was introduced in 1860. This is the rapidly growing tree which is being extensively planted in the drier Middle Western States. *U. parvifolia* is slower growing and scarcely winter hardy much north of Philadelphia; but, with its dark and roughened bark and small glossy leaves, a mature specimen of this species is an exceedingly handsome tree. *U. parvifolia* flowers in early September, and on December 8 this year it still carried a heavy crop of fruit. The Siberian Elm, *U. pumila*, flowers in May and ripens its fruit soon afterwards. Time of flowering is thus a certain character by which the two species may be distinguished.

THE COVER DESIGN is a pen drawing of the new head-house erected in recent months across the west end of the existing "growing-on" greenhouse. The new greenhouse is not visible from this angle.

Construction is of native Chestnut Hill stone and of a design to harmonize with its surroundings and which has also permitted the reutilization of the small paned windows, interior doors and other material from an old but outmoded structure at the Farm. The pleasing weathered-gray Salem Colonial roof shingles are of a type originally designed for the principal buildings of restored Williamsburg.

The lower floor of the building provides storage place for tools and mechanical equipment, together with a suitable headquarters and facilities for the men of the Arboretum. The upper floor, on a level with the greenhouses, contains an ample work and potting room, offices for the head gardener and for records, a tool room and a small laboratory in convenient proximity to the research section in the new greenhouse. There is also a large and well lighted storage loft.

Both cover drawing and frontispiece photograph are by Gustave Liebscher.

Henry T. Skinner

AN INTERESTING VARIANT OF WHITE SPRUCE

IN August, 1941, a striking and decorative departure from the normal white spruce, *Picea glauca* (Moench.) Voss., was found growing wild on Mount Desert Island, Maine. The variant, which appears to be distinct from forms previously described, is represented, so far as observed, by a single tree growing in a clump of typical wild native white spruce trees (Fig. 1). It is located on Otter Cliff, between



FIG. 1. *Picea glauca* (Moench.) Voss. forma *buxoides*. Specimen on Mt. Desert Island, Me., with neighboring normal white spruce.

Otter Point and Thunder Hole, on the ocean side of Ocean Drive in the Acadia National Park.

The tree is pyramidal in form (not unlike the normal), about thirty-five or forty feet high, and is sixteen inches in diameter at breast height. Nothing definite is known concerning its age, but there is no obvious evidence that its growth rate has been essentially different from that of the typical white spruce trees all about it. Leaves do not differ markedly from those of the parent species, although in color the foliage mass may give the effect of a somewhat denser and darker green.

Its most striking characteristic is undoubtedly the very dense compact outer surface, giving the tree, as the proposed name (*Picea glauca* (Moench.) Voss. forma *buxoides* forma nova*) indicates, a box-like appearance. But the resemblance to box is in the surface only; obviously the tree is neither shaped like box nor dwarfed, but erect, pyramidal, and excurrent.



FIG. 2. Showing the densely branched, box-like surface of the variant, with an occasional normal shoot in which the intricate branching has not yet set in. The prominent hump (upper center) doubtless had a similar beginning.

Closer examination reveals that the box-like surface is due to branching at the periphery, which becomes so intricate that the branchlets crowd each other both horizontally and vertically. The result is an outer surface so "solid" and compact that, seen from the outside, it hides all within. So dense is this periphery that it alone retains living needles, all the rest being shaded out. Looking up into the tree from below, this needle-bearing outer surface, only eight to twelve inches thick, appears as a continuous green shell, all within being bare. But for the trunk and bare branches, one might liken the tree to a giant tea caddy.

* Specimens from the tree have been deposited in the herbaria of the Morris Arboretum and of the Department of Botany, University of Pennsylvania.

Occasionally, the tip of a lateral branch grows out without undue branching and comes to project beyond the general surface of the tree (Fig. 1, left center, and Fig. 2, upper center). In all probability this "reversion" is temporary and dense branching sets in sooner or later, converting the projecting branch into a dense hump merging into the rest of the compact surface. It is in this way that the protruding bulges, occurring here and there on the surface of the tree, are believed to have developed. The leader appears not to be subject to the excessive branching. If it were, even occasionally, it would be difficult to understand how the tree from the beginning maintained a continuous central excurrent shaft.

Nothing is known of the genetic character of the variant. It is unlikely that it would come true to seed. When seen in August, 1941, the tree bore a goodly scattering of cones, which appeared normal in size for white spruce, in the upper part. If these bear viable seed, it may be possible to put the matter to the test. Despite the lateness of the season, cions sent in August, 1941, to the Arboretum were apparently successfully grafted on Norway spruce by Mr. Henry T. Skinner, Curator of the Arboretum. Additional cions will be secured for grafting early next spring, in order that the horticultural possibilities of this interesting variant may be more fully determined.

J. R. Schramm

THE ORIGIN OF THE BANANA

A "GRAFT" STORY THAT LASTED OVER 500 YEARS

THE BANANA is a native of southeastern Asia. It was probably cultivated in its native habitat as early as 2000 years before Christ and its cultivation soon spread to neighboring lands. It had reached India well in advance of the invasion of that country by Alexander the Great. The Greeks thus learned of the plant, and Theophrastus described a fruit which we can identify positively as a true banana (*Eumusa*).

The actual spread of banana culture from India to the Mediterranean World, however, was greatly delayed. Neither the Egyptians nor the Hebrews have any record of the fruit and in the early centuries of the Christian era it was known in the West only from specimens cultivated in the gardens at Alexandria. Later, when the Arabs took control of the southern and eastern coasts of the Mediter-

anean, the banana became an important article of diet and the Arabic descriptions of the plant are numerous and detailed.

Sometime between the introduction of the banana into Egypt and the widespread cultivation of the fruit by the Arabs all knowledge of the plant's original home was lost. Thus the Arabian philosophers found the banana to be somewhat of a problem. In fact they were in a dilemma. They believed that all good plants originally grew in the Garden of Eden and that the Garden of Eden was in no very distant country. Why, then, did not the old and sacred records mention the bananas along with dates and figs and other well known fruit? A way out of this dilemma was suggested, perhaps, by the fact that the tiny, abortive seeds of cultivated bananas would not germinate. The banana was sterile like the mule, and it could be propagated only vegetatively by transplanting suckers cut off from the base of the parent plant. If the banana was a hybrid, the problem was solved, for a hybrid plant need not have been produced during the original act of Creation. It need never have been in the Garden of Eden at all in spite of its modern name—the fruit of Paradise (*Musa paradisiaca* var. *sapientum*). In fact the hybridization which originally produced bananas could have occurred so recently that it was antedated by the sacred writings and thus their failure to mention bananas was explained.

Of course, any real hybridization would involve pollination and a sexual union of diverse parental stocks. The Arabs recognized sex in the date palm, which they pollinated by hand, and in the fig which they fertilized by the capra-fig, but here the matter ended and the real sexual nature of plants in general remained unknown. Ordinary grafting, they thought, was in some vague way a sexual phenomenon. Indeed, the increased productivity of grafted plants was due, supposedly, to the act of grafting itself, assisted, of course, by some symbolic magic.

The alleged hybridizing operation which produced the banana is described by an Arabian scientist, Abd-al-Latif, who lived from 1162 to 1231 A.D. The account is found in his book "Descriptions of Egypt." From the French edition (Paris, 1810) p. 26:

"It is affirmed that the banana tree came originally from a mixture of the Egyptian water-lily (*Colocasia*) and the seed of the date; in order to produce this composite vegetable it is necessary to force a date seed into the interior of the tuber of the water-lily and to plant it in this manner."

This story, of course, grew and more details appeared. Salvatore Cusa (*Archivio Storico Siciliana*, 1873) summarized the belief as follows: "One [graft] was used, however, of the palm upon the colocasia from which they believed sprung a fine banana. For this purpose, they directed, you shall make an incision with a gold knife in the foot of the colocasia and within this you shall put a fruit stone of the female date, which is rounder and shorter than the male, you shall bind it completely and cover it with sticky clay, mixed with a few hairs covered with plant soil. Having done this grafting in January you will be able to gather fruit of the banana in July or August."

The directions for making this graft hybrid were specific and detailed. It would seem to us, with our present scientific notions, that nothing would be easier than for the Arabian scientists to try the experiment and record the positive or negative results. Obviously, however, they had other standards, for no negative evidence, even if any was obtained, was allowed to kill such a good story. More than five hundred years after Abd-al-Latif, this method of manufacturing bananas was still in good repute, as we learn from the testimony of Frederick Hasselquist, a pupil and friend of the great Linnaeus. Hasselquist traveled in Egypt, Palestine and Syria in the years 1749-1752, where he gathered material for his "Voyages and Travels in the Levant."

A number of his letters to Linnaeus were published as an appendix to this work. The following quotation is taken from the letter dated Cairo, September, 1750:

"I would speak of the Plantain-tree or Musa, the queen of plants, but it commands me to be silent, as it has had the good fortune to be completely described by the greatest master. I will however mention an old story, which is taken for granted by the Egyptian gardeners: they say that it can be produced by planting the kernel of a *Date* in the *Colocasia*, and that this was its first origin: a singular history of creation. I asked them, whether they ever made trial, as they so obstinately defended the truth of it; but they answered no, and that it was not worth while, as the plant grows so freely without culture: *et fabulosa juvant*."

Conway Zirkle

Department of Botany,
University of Pennsylvania.

WATER-IN YOUR EVERGREENS

BEFORE the ground becomes frozen too deeply, it is worth thinking about the question of whether your evergreens have enough moisture around their roots to carry them through the winter. All of us remember only too well what happened to so many of our evergreens last year. Many of the narrow-leaved ones and in particular the broad-leaved Rhododendrons showed a great mortality rate last



FIG. 3. If your Rhododendrons are in this wilted condition on warm days, it means they are suffering from an extreme lack of available moisture.

spring. Following the long cold spell which had the soil water frozen, the sudden warmer spell accompanied by high winds in the middle part of last March caused water to be given off from the leaves which could not be replaced by the roots. Thus many of our prized clumps of Rhododendrons as well as parts of some of the narrow-leaved evergreens were killed. Death in this case was not caused by freezing, but by the lack of available moisture for the roots.

The abnormality of the environment, such as lack of summer rains and warm winds in late winter, we cannot help. But we *can* see to it that our plants go into

the winter season with plenty of water in the surrounding soil. The latter part of this summer and the early part of the fall have been extremely dry. If nature does not give us any water before the winter sets in completely, it is obvious that the freezing ground will catch our plants unprepared for the winter before them. To prevent this, let us see to it that all of our evergreens receive a good watering. On a day which is not below freezing, let us just lay a hose on the ground and let it run slowly all day. For further protection for the broad-leaved ones let us see that in addition to the water they have a good mulch of peat moss or oak leaves. This will prevent evaporation from the ground and will tend to prevent the soil from freezing so deeply.

The more care and affection we give our plants this fall, the more affection they will show us next spring—with good foliage.

Spencer H. Davis, Jr.

TREE-WOUND DRESSINGS

THIS PAPER embodies a brief discussion of tree-wound dressings and is the third in a series on Tree Care prepared by the writer.

Our knowledge of tree-wound dressings is in a controversial state. When tree wounds are not properly treated, or receive no care, the span of life of a tree is shortened. The proper care of wounds in trees is as necessary for their well being as for our own bodies. The organisms which cause disease in trees—and eventually ugliness and death—are in a sense more subtle and insidious than the vast percentage of those which may affect our own bodies, because they so often act more slowly and their work may be beyond repair even before it can be detected by the naked eye. Especially is this true of wood-destroying fungi, which gain entrance into trees only through injuries or wounds in the outer covering, epidermis and bark. Since these organisms, as well as wood-destroying insects, are ever lurking about it is essential for the well-being of the tree to protect its wounds with antiseptic and waterproof dressings.

Purpose and essential properties of wound dressings

The primary purpose of a tree-wound dressing is the preservation of the exposed living bark, cambium, and heart-wood against destructive fungi and insects. The essential virtues of a tree-wound dressing should be:

1. The inability to cause serious injury to the cambium and accompanying tissues.
2. The capacity to penetrate the wood.
3. A chemical content of effective germicidal value.
4. The ability to prevent as much as possible the drying out and cracking of the wood.
5. The property of being practically insoluble in water.
6. The power to withstand extreme temperatures without being seriously affected.

Choice of wound dressing

Many tree-wound dressings have yielded more or less satisfactory results. But the kind which should be used will depend upon various factors, *viz.*, the size of the wound and its location—especially with reference to other wounds and particularly if they have decay—and its proximity to the ground; the kind of tree, its location, and physiological tone; the time of year the cut is made, etc. In fact there is much of vital importance involved in the treatment of the wounds of trees which cannot be adequately discussed in this brief account.

For wounds less than one inch in diameter, a good coating of orange shellac is usually sufficient. In case of larger wounds, it is important to use at least two different types of dressings, namely, one which is primarily a germicide, the other, a waterproofer.

Germicidal wound dressings

Due to its alcoholic content, orange shellac is one of the best germicidal tree-wound dressings in use at the present time. It is also a preservative, because it readily penetrates the wood. The inner living bark, the cambium, and the sapwood should be thoroughly coated with shellac as a protective covering before waterproofing dressings are applied because these materials may often severely injure these tissues. The writer does not regard orange shellac alone as a permanent tree dressing, but it is one of the best known materials for the protection of the cambium. Surgeons' or nurserymen's tape may be used at times in its place. A solution of copper sulphate (blue vitriol) (one pound to three gallons of water); also one of corrosive sublimate (7-7.3 grain tablet to one pint of water) have been recommended for the treatment of the exposed wood. Corrosive sublimate solutions should not be prepared in metal containers and should be used with caution since they are injurious to the skin. Germicides which are mixed in water do

not have the penetrating power of the alcohol in shellac; and if they are used, the inner living bark, the cambium, and the sapwood should first receive the shellac treatment.

Waterproofing dressings

Materials such as asphaltum and creosote paints, other commercially prepared paints, also those containing lead and zinc are generally used to sterilize and preserve the exposed wood. A few waterproofing dressings which seem to be most worthy of note are discussed in the following paragraphs.

Asphaltum. A number of tree-wound paints containing asphaltum may be obtained from various dealers. The paint which one investigator found to be most satisfactory, as compared with some other dressings, is asphaltum dissolved in a volatile hydrocarbon (gasoline, xylol, benzene). He found that it "consistently stimulated callus formation during the first year following treatment," and "was superior to others in preventing checking and cracking of the wood." Asphaltum dissolved in turpentine or mineral oil may often be injurious to the cambial region of the wound. The same is true for creosote mixtures, such as creosote and asphaltum, and creosote and coal tar, which are suitable for cavity work provided they are not applied to the cambial zone. In case these and the heavier asphaltum mixtures are used, it is highly important that about one-half inch on each side of and including the cambium be first shellacked. Creosote and its mixtures may often severely injure the living tissues in cherry, peach, plum, magnolia, tulip, maple and other trees.

Asphaltum paints and creosote and its mixtures are not always completely germicidal. Investigations have shown that a number of asphaltum paints are not antiseptic to the spores of some fungi. The same is apparently true for coal tar and creosote dressings, judging from the writer's observations of pruning cuts which were kept coated with these materials but in which wood decay appeared within four years. The wounds were not sterilized before the dressings were applied.

Bordeaux paint. This material is composed of Bordeaux powder and raw linseed oil. It is strongly germicidal and seems to be a superior dressing as a wood preservative, which is highly essential until the wound is completely callused over. Bordeaux paint cannot be applied as readily as some paints. A very thin coating is first rubbed thoroughly into the wood and then followed immediately by a heavier coating.

Bordeaux paint has a tendency to retard the development of the callus during the first season, but its high fungicidal power certainly warrants its use, especially on large wounds. It is objectionable because of its color and may not be desirable on ornamentals in prominent locations.

Lead and zinc paints. Good lead and zinc paints often prove effective waterproofers, provided the wound is sterilized before they are applied and is kept coated with the paint until completely callused over.

Shellac, varnish, paint. Where the color of the wound dressing is objectionable, the cambial region can be first shellacked and then the exposed wood sterilized with a copper-sulphate solution. After the surface of the wood has dried, it should be coated with shellac; when the shellac has hardened, it may be painted with a paint which will match the bark. After drying, the durability of the paint will be prolonged by a dressing of spar varnish. Or the paint may be omitted and a good spar varnish used in its place. The shellac-paint-spar varnish dressing is, in the writer's judgment, one of the most satisfactory tree-wound dressings. The main objection is the amount of time involved in application, but on particularly choice and conspicuous trees it certainly is desirable.

Wound dressings on Conifers

A common belief prevails that the wounds in trees which produce considerable amounts of resin, such as pines, spruces and other conifers, do not require special dressings, as do our deciduous trees. But, unfortunately, the resin which exudes from wounds on conifers is by no means completely fungicidal. The writer has learned by his own investigations that many wood-destroying fungi infect at least some conifers, pines, and spruces through wounds where the exposed wood may be heavily coated with resin. In fact, these organisms, as well as others, may be largely responsible for copious exudations of resin. The writer believes that large wounds in conifers should be protected with wound dressings until callused over, and that they should be inspected as regularly as those on deciduous trees.

Inspection of wounds

No matter what dressing is used, tree wounds—especially those an inch or more in diameter—tend to check and crack open. This condition does favor very greatly the entrance of wood-destroying organisms. It is of very real importance that wounds be examined two to three times or more per year and kept coated over until callusing is completed.

In addition to checking and cracking, blistering—especially on large wounds—sometimes occurs. This condition seems to arise more frequently where creosote and asphaltum mixtures and other commercial paints have been used. Very commonly blistering is due to the exposed wood being insufficiently dry when the waterproofing is applied.

Conclusion

Wound dressings may yet be discovered which will yield better results and be of far more general application than those we now employ. Even the best of those we now use might become more effective with the keeping of case records and a better understanding of the real nature of trees. Our knowledge of how trees respond to the ever-changing factors of their environment, of the morphological and histological relations of branches to the part of the tree from which they arise, of the relations between callusing and the physiological tone of the tree, and of the biology of fungi and insects ever ready to prey upon them, is still so very inadequate.

Harlan H. York

*Department of Botany,
University of Pennsylvania.*

NOTES AND COMMENTS

THE MORRIS ARBORETUM takes pleasure in welcoming the following new Associates: Mrs. John C. Gilpin, Mrs. George Gowen Hood, Mr. Wm. Clarke Mason, Mrs. E. F. Rivinus and Mr. Walter Lee Sheppard, of Chestnut Hill, Philadelphia, Pennsylvania; Mrs. William G. Bond, of Holly Oak, Delaware; Miss Margaret Lancaster, of Fort Washington, Pennsylvania; Mr. Henry F. Riebe, of Germantown, Philadelphia; Mr. Robert M. Saul, of Rose Valley, Pennsylvania; and Dr. Donald R. Young, of Philadelphia.

J. R. Schramm, Director of the Arboretum and Head of Department of Botany, is continuing his research on the problems of reestablishing plant populations in the devastated Pennsylvania coal regions. In a progress report delivered before the Botanical Society of Pennsylvania on November 15, Dr. Schramm discussed a number of interesting points which have already emerged relative to the inability of plants to naturally repopulate these regions, presenting evidence, at the same time, that artificial methods of repopulation show distinct promise of success.

John M. Fogg, Jr., Associate Professor of Botany, assumed, on July 1, his new duties as Dean of the College of Liberal Arts and Sciences and Director of the College Collateral Courses of the University. Dr. Fogg plans to continue to teach and to carry on his studies dealing with a comprehensive account of the flora of Pennsylvania. Following the close of Summer School, Dr. Fogg and his family left for a visit to the southwestern states. Although this was primarily a pleasure trip, it provided abundant opportunity for botanical observations. Collections were made at a number of localities, principally in New Mexico, Arizona, Utah and Colorado, resulting in the accumulation of several hundred specimens which will be added to the herbaria of the Department of Botany and the Morris Arboretum.

William Seifríz, Professor of Botany, is the author of an article entitled "Reproductive Cycles in Plants" appearing in *The Caribbean Forester*, Vol. 3, No. 1, October, 1941. Illustrating by means of his unique motion pictures of protoplasmic movement, Dr. Seifríz addressed the Torrey Botanical Club in New York on the subject of the "Physical Properties of Protoplasm" on December 2, and gave a similar lecture at Hamilton College, New York, the day following.

Continuing his studies on the genus *Phlox*, Edgar T. Wherry, Professor of Botany, has recently published accounts of two representatives of this genus which merit the attention of horticulturists. In the April number of the *National Horticultural Magazine*, under the title "A New Hybrid Phlox," was described \times *Phlox henryae*, a new hybrid. This had arisen spontaneously in the rock garden of Mrs. J. Norman Henry, at Gladwyne, Pennsylvania, and represents a hybrid of *Phlox bifida* and *P. nivalis*. Photographs accompanying the article show it to combine the features of the parents; in its relatively large corolla-limb it suggests the second-named species, but the deep notches in the lobes show the influence of the first. The color is a soft pink scarcely attained by any phlox now in rock gardens. The plant is to be propagated and distributed by the Nik-Nar Nursery, Biltmore, North Carolina.

In September, in the *Notulae Naturae* of the Academy of Natural Sciences of Philadelphia, Dr. Wherry published an account of the Phloxes of Idaho. It was found that sixteen species grow in this state and one of these, new to science, was named *Phlox idahonis*. This is not a rock plant, but grows in moist grassland, its leafy stems reaching a height of 20 to 30 inches. It bears in summer a flat-topped cluster of lavender-blue to purple flowers, three quarters of an inch in diameter. If this proves capable of cultivation under our eastern climatic conditions, it will be an interesting addition to the series of species phloxes for wild

gardening. The tangled nomenclature of several other phloxes is straightened out in the same article and a number of new species are described.

W. G. Hutchinson, Assistant Professor of Botany, attended the June meeting of the American Association for the Advancement of Science at Durham, New Hampshire, and spent most of the summer in research on various aspects of the biology of *Chromobacterium violaceum*. In this connection he will present a paper, prepared in collaboration with Mr. Albert Kelner and entitled "Study of Secondary Colonies of *Chromobacterium violaceum*" at the December 29 meeting of the Society of American Bacteriologists in Baltimore. Dr. Hutchinson was recently elected Secretary of Sigma Xi.

Harlan H. York, Professor of Botany, spent the past summer as Consulting Forest Pathologist and Special Investigator for the New York State Conservation Department, conducting investigations on forest diseases in the artificially established Municipal forests of the City of Rochester, New York, which are located on the watersheds of Hemlock and Canadice Lakes. About the middle of August Dr. York gave a special talk on "Idle Lands and Reforestation" before the Rotary Club at Wayland, New York, and in the following week he conducted a field tour for the members of the Club through the forests mentioned above.

Paul J. Allen has been appointed Instructor in Botany and will be engaged in research and teaching in the particular field of Plant Physiology. Dr. Allen holds the degrees of Bachelor of Arts from Harvard, Master of Science from the University of Rochester and Doctor of Philosophy from the University of California, where he was latterly teaching in Botany.

Louis C. Wheeler has also recently joined the staff of the Department of Botany as Instructor. Dr. Wheeler is a graduate of the University of California, continuing his studies towards the degrees of Master of Science at Claremont College and Doctor of Philosophy at Harvard. His experience in Botany includes an Assistantship at the Gray Herbarium and Instructorships at the University of Missouri and the American University.

Doctor Wheeler is currently engaged in work on the proposed Flora of Pennsylvania and on the classification and distribution of the *Euphorbiaceae* (Spurge or Castorbean Family), which family furnishes over 95 percent of the world's natural rubber. He has been responsible for checking the scientific names of this plant family for the second edition of Standardized Plant Names, which is to be published shortly.

James Lambert, Superintendent of the Botanic Garden at the Department of Botany, returned in September from a month's plant collecting tour in Mexico, travelling by way of Nuevo Laredo, Victoria, the Sierra Mădres and the basin valley to Mexico City, thence by way of the Sierra Nevado Mountains to Cholula, Puebla and Orizaba Mountain to Fortin—famous for its gardenias and as the home of *Mimosa pudica* (Sensitive Plant). Specimens of plants collected in the desert, mountains and tropics are now being identified for permanent use in the University and Arboretum Herbaria.

Mr. Lambert delivered a radio broadcast on the subject "Protecting Plants for Winter" as guest speaker on the WCAU Farm Hour on November 22, and is continuing a series of talks on "Plant Exhibits" at the monthly meetings of the Botanical Society of Philadelphia.

Spencer H. Davis, Research Assistant in the Arboretum, attended the National Shade Tree Conference at Washington, D. C., on August 27. Mr. Davis is author of an article entitled "Fertilizing Precautions to Tree Men" appearing in *Arborist's News*, Vol. 6, No. 6, 1941 and of a second to appear in a forthcoming issue of *Science* on the subject: "Sclerotium Bataticola a Cause of Damping-Off in Conifer Seedlings."

Henry T. Skinner, Curator of the Arboretum, has been reelected Vice-President of the American Association of Botanic Gardens and Arboretums, and continues as Department Editor of *Parks and Recreation*, the Official Publication of the American Institute of Park Executives and affiliated Societies. He attended a meeting of the above Association at Morton Arboretum, Chicago, Illinois, on October 11 and was appointed Association Delegate to the National Council on Plant Names which met in New York City on November 22.

Mr. Skinner has been invited to address the Pennsylvania Horticultural Society on the subject of "English Gardens" on January 13 and, discussing the "Preparation of Plants for Exhibition," will be a guest speaker for the Judging Course of the Federated Garden Clubs of New York State being held in New York, January 13-16.

The Morris Arboretum was awarded a Silver Medal by the Pennsylvania Horticultural Society for its exhibit of ornamental berried shrubs again staged in cooperation with the Arthur Hoyt Scott Foundation at the Fall Flower Show at Swarthmore College. Mr. John Tonkin and Mr. Joseph Adams of the Arboretum share credit with Mr. Harry Wood and Miss Smith of the Arthur Hoyt Scott Foundation for the annual success and popularity of this exhibit.

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